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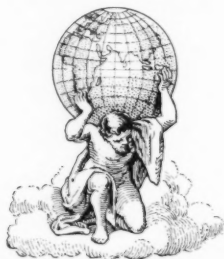
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Editorial Notes.

JUST four years after the British Broadcasting Company came into being—in November, 1922—preliminary particulars have been issued of the lines on which its activities will be administered when the service is taken over next month by the Postmaster-General. Though the announcement deals chiefly with the internal organization of the new Corporation, it indicates the amounts that will be available for the service, and so affords information on what was perhaps the chief matter for concern in regard to the new arrangement. Up to the present the Post Office has retained one half of the revenue derived from wireless licences; in future, after a deduction of $12\frac{1}{2}$ per cent for the cost of collection, amounts varying with the number of licence-holders—90 per cent for the first million to 60 per cent for the fourth and upwards—will be paid over to the Corporation. The concern should therefore be richer than its predecessor, and it starts with the advantage of an equipment already in full operation. Over two million licences have been issued for the current year, and there is now a wireless installation in every third or fourth home, a greater percentage than in any other country. During the three years since the present form of licence came into force, the number issued has increased three and a half times. Wireless, in fact, has already become so commonplace that it is difficult to recall

the early days before the B.B.C. was established, when it was quite an adventure to “pick up” a station, without knowledge of its wave-length, or whether, indeed, it would be broadcasting at all at the particular moment of our experiment.

* * * * *

The Postmaster-General already had a monopoly of telegraphic and telephonic transmission in this country when it was later made law that control should likewise be exercised over wireless communication. Without wishing to question the perfectly definite legal position, we confess to not having understood the reason for the forthcoming alteration or grasped its significance, until we read an interesting article by the managing director of the B.B.C., in its official organ *The Radio Times*. In this he explains that in general the change is taking place because, in view of the magnitude of the public obligations involved, a commercial constitution of any sort, and however slight, appears invidious; and more particularly because such large sums of money were accruing from licence revenue that it appeared desirable to have a different constitution, with public instead of trade representatives on the board. Mr. J. C. W. Reith, who is to remain the chief executive officer under the new title of Director-General, goes on to deal with certain misconceptions that had arisen with regard to the Corporation. He says the commonest seems to be that the broadcasting organization is to become a state concern. While in one sense this is true, the service is not to be administered by the state, nor are the staff to be civil servants.

* * * * *

The Government is making arrangements for its conduct in the next ten years, and the Corporation is to be established by Royal Charter; but the Postmaster-General has stated that it was his desire to establish the new body with as great a degree of independence as Parliament was ready to accept. We have already mentioned the necessity for adequate finance: Mr. Reith states that further progress in broadcasting—

or rather the maintenance of the rate of progress—is dependent on this factor, and he commits himself to the statement that “the great line of advance lies in the direction of high-powered regional stations and alternative programmes.” He mentions elsewhere that the original company was under obligation to erect eight stations, and that in the four years of its operation it has erected twenty-one. Without venturing into the realms of technological controversy, we refer our readers to the discussion of the new short-wave system in our wireless notes on another page, from which it appears that communication by this method may probably render high-powered stations unnecessary. Also, not only is the operation of short waves cheaper, but they have great possibilities from other points of view.

* * * * *

Interesting treasures have been brought to light in the Royal Tomb discovered at the Giza pyramids last year, which is now under excavation by Dr. Reisner and Commander Wheeler, on behalf of the Harvard University and Boston expedition. According to the Cairo correspondent of *The Times*, the tomb has been identified by recent work as belonging to Queen Hetepheres, consort of Seneferuw, and it is therefore fifteen hundred years older than that of Tutankhamen. The date is based on four inscriptions in gold hieroglyphics inlaid on the back of the carrying-chair discovered in the tomb, while markings on other objects are stated to confirm this identification. The most impressive of the finds was a gold-cased jewel box, bearing the queen's name and containing ten pairs of silver anklets, each graduated to fit the leg as it increased in size upwards. It is reported to be evident that Queen Hetepheres was first buried beside her husband in the pyramid at Dahshur, but owing to thieves breaking into this, her son Cheops had her mummy transferred to the secret tomb beside his own burial pyramid temple at Giza. As it was at the time unfinished, the funeral objects from Dahshur were put into the new tomb in the order of their arrival, and many of them were discovered by the American expedition just as they had been left, still packed in their removal cases and stacked in the chamber. There is surely as much interest in the human story disclosed by these discoveries as in the wonderful objects themselves.

* * * * *

New light on a perplexing but important point in the staging of one of Shakespeare's plays is shed by an article by Mr. St. John Ervine in *The Observer*

last month, which deals with the grave scene in “Hamlet.” Undoubtedly prompted by the recent London presentations of the play in modern dress—in which the defect was particularly marked—the critic confesses he has never seen the burial of Ophelia performed without a sense of bewilderment and even of outrage and anguish. The grave, as usually staged, suggests the narrow sepulchre of the modern cemetery, and after the coffin containing Ophelia's body has been lowered, Laertes, and then Hamlet, leaps into the grave, where they struggle in fight. Outraged by the thought that these men were standing and fighting on the coffin, Mr. Ervine's horror was increased when he reflected that the burial was done in an age when bodies were interred without coffins; and yet the alternative possibility that Ophelia was buried instead in a vault, such as that in which the drugged Juliet was laid, is defeated by the fact that the grave-diggers dug into the earth.

* * * * *

The article reminds us that the stage directions in Shakespeare's plays are not those of the author himself, but have been added by his various editors; and while generally appropriate, they can safely be assumed as sometimes unsound or incomplete. In regard to the Hamlet problem, it has been suggested to Mr. Ervine by a dramatist of distinction that the solution is to be discovered in the text itself, as Shakespeare's stage directions are nearly always contained in his dialogue. Adopting this method, it becomes apparent from the speech in which Laertes addresses the grave-diggers:

Hold off the earth a while,
Till I have caught her once more in my arms.

that either Ophelia is not in a coffin at all or that, if she is, the coffin is open. The only stage direction included by the editors is that Laertes “leaps into the grave.”

It seems clear, writes Mr. Ervine, that Laertes has done something more than [this], and my friend suggests that Laertes has actually seized Ophelia in his arms and clutched her to his breast. When Hamlet comes forward, Laertes, hearing the voice of the man to whom he attributes his sister's death, lays the fragile body, not back in its coffin (if there be one) or on the bottom of the grave, but on the bank by its side. Then, when Hamlet leaps into the grave, and he and Laertes engage in a struggle, they are struggling not on the dead body or the coffin, but on the bare earth.

Whether this interpretation be agreed with or not, it certainly takes away the horror ordinarily inspired by the scene; and we hope it will be put to the test at the earliest opportunity.

New Lights in Chinese Archaeology.

By R. L. Hobson,

Keeper of the Department of Ceramics and Ethnography, British Museum.

Interesting theories as to the origin of Asiatic peoples, forthcoming from the discovery in China of pottery similar to that found as far west as Eastern Europe and Western Asia, have now been amplified by the excavations of Swedish archaeologists. The new finds will shortly be exhibited in Stockholm.

WHILE systematic excavations carried out in selected places in Europe and the Near East during the past century were producing results at once intensely interesting to the world at large, and of first importance to history and archaeology, the secrets of ancient China remained effectively hidden in the ground.

The Chinese, an ancestor worshipping people and deeply imbued with reverence for the past, jealously guarded the tombs of their fathers. It is true that they never objected to uncovering the burial grounds of races which they regarded as non-Chinese, even though these races were domiciled on what is now Chinese soil; but the severe penalties long in force against disturbers of Chinese graves discouraged excavations of any kind, and it is only in quite recent years that the necessary disturbance of the soil by builders of roads and railways has revealed the tremendous archaeological possibilities of China.

One result of the lack of spadework in Chinese archaeology has been to leave the early history of this wonderful country to the mercy of the arm-chair theorist. The origin of the Chinese race is still largely a matter of speculation, and it has even been seriously doubted whether any palaeolithic

or neolithic* culture had existed in what is now one of the most populous tracts of the world.

A few years ago Dr. (now Professor) J. G. Andersson,

the Swedish geologist, thanks to exceptional opportunities he enjoyed as an official of the Geological Survey of China, was able to locate certain prehistoric sites which could be excavated without wounding Chinese susceptibilities. In these he found remains of neolithic man, including a quantity of pottery of which one type was obviously related to the known Chinese pottery of the earliest historic periods, while another was different from anything previously found on Chinese



PAINTED POTTERY, OF THE NEOLITHIC PERIOD, DISCOVERED AT KANSU.
This vessel, 8.3 inches in height, is now exhibited at the British Museum.

soil. This latter group displayed a surprisingly advanced technique. It was a refined material, thinly potted, highly fired, in colour ranging from red to buff white, and skilfully decorated with painted designs in red, black, purplish-black, and white clays.

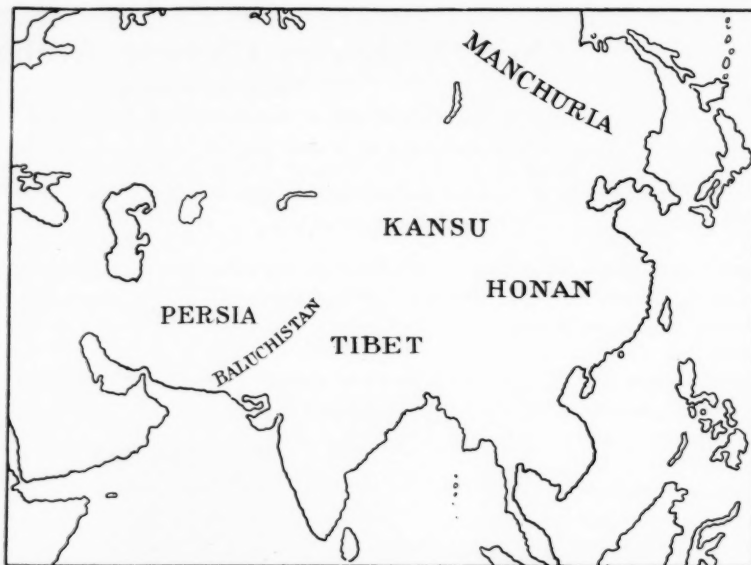
The discovery of such pottery in China created a sensation among European archaeologists. The manner of its manufacture, its general appearance,

*The terms "palaeolithic" and "neolithic" as applied to Chinese culture do not necessarily connote any date, but refer only to the stages of culture in which rough stone implements of the old Stone Age and the more finely worked implements of the new Stone Age were characteristic.

and the recurrence on it of certain kinds of decorative design, all recalled the pottery found on neolithic and early Bronze Age sites in Eastern Europe and Western Asia, *viz.*, at Tripolye in South-western Russia, at Anau in North-eastern Persia, at Susa, at Ur, and as far east as Baluchistan. Interesting speculations were at once suggested. Was China after all connected with the Near East in its very early days? Were the primitive inhabitants of China the same race that lived at Anau and Susa? Was there a common origin for the neolithic inhabitants of both extremities of the Asiatic continent? Or were the resemblances observed in the pottery merely fortuitous?

Clearly the subject demanded further investigation, and thanks to an energetic group of scientists in Stockholm, powerfully supported by the Crown Prince, a society was formed to further Dr. Andersson's researches. The results proved highly encouraging. Dr. Andersson extended his research in a westerly direction along the traditional lines of communication between China and the West, and he discovered quite a number of sites, reaching from Honan to the borders of Thibet, in which pottery of the kind described was found in large quantities. Some of these sites were still quite neolithic; while others contained metal objects in varying quantity, proving that the culture thus discovered extended into the Bronze Age.

The Swedish Government has allocated funds for a new museum in Stockholm in which Dr. Andersson's finds will be exhibited for all the world to see. At present it is enough to say that much of the early pottery is strikingly handsome in form and decoration, and that it will make a display which will astonish as well as interest all comers. Meanwhile, until the whole material has been studied and published, as it will be in due course, it would be premature to interpret its bearings on the important question of the origin of the primitive races in China. The people of the painted pottery have been traced from Manchuria to the western border of Kansu. There is still a wide gap between this point and the finds of similar painted pottery in Western Asia. Can it be bridged? If there was indeed a connexion between the peoples of Eastern and Western Asia in primitive times, by what route did they communicate? There are two known alternatives. One is the ascertained trade route which



MAP TO ILLUSTRATE THE PAINTED POTTERY FINDS IN ASIA.

The people of the painted pottery have been traced from Manchuria to the western border of Kansu. Possibly evidence of connexion between their relics and the similar finds in Western Asia will be discovered along a trade route which passed through Chinese Turkestan or by that farther north through Southern Siberia.

ran across the now sand-buried and desert tracts of Chinese Turkestan. Parts of this route have been explored in recent years by Europeans, such as Drs. Von le Coq and Sven Hedin, and Sir Aurel Stein; but the finds made in various parts of the route have not so far included any of the neolithic painted pottery. The alternative route is farther north and passes through Southern Siberia. Migrations of primitive peoples might have proceeded by either of these routes, and it still remains to search them for traces of such movements. It is probable that Dr. Andersson may yet address himself to this task. If he succeeds in the bridging of the gap, and either in proving the migrations of the people of the painted pottery from East to West or vice versa or, what is perhaps more probable, a common origin in Central Asia for both the Eastern and Western groups, he will have completed one of the more interesting archaeological achievements of the century.

A Correction.

In our November issue, "Scientific Problems of the Amazon Valley," page 396, the word "petricliff" was misprinted for "petroglyph," meaning, of course, inscription in stone—such markings as described by the author occurring on rocks in other parts of America. Separated from its context, the incorrect term was included in the title of the illustration on page 394, from which it should be deleted.

Researches on the Two-Spot Ladybird.

By T. F. Marriner, F.E.S.

Since ladybirds are particularly beneficial to the plant grower, detailed researches into their life-history problems are now being undertaken. As a result of original investigations, the author describes the typical Two-Spot ladybird and the interesting discovery of a hybrid form of this insect.

THE popular notion of a beetle is that it is something both objectionable and repulsive and to be got rid of as quickly as possible. There are, however, many beetles which are real gems of beauty, and where this is the case public opinion calmly ignores their beetle nature and bestows upon them some other name. Hence the pretty little ladybirds are not in the public mind classed as beetles, but as the lady's birds, and no one objects when one alights upon the hands or the clothes.

One of the commonest and one of the prettiest of our British ladybirds is known as the "Two-Spot." Besides being pretty this little ladybird is one of the very best helpers the grower of plants could possess, though it is to be feared that in the earlier stage of its existence, the larval stage, it often pays the penalty of being found in the evil company of the green-fly—the aphid—through ignorance of its identity and its mission on the part of the grower.

The economic value of the ladybird, in fact, is only beginning to be fully appreciated in this country. Much good work has been done in the United States, in France, and in Germany in connexion with this group of the coleoptera, but there is still much to be investigated. The Board of Agriculture has taken the matter up recently, but independent workers are wanted, and this article may serve to point the way in which to set about this research.

The Two-Spot spends the winter months in hibernation behind the loose bark of trees, in cracks in telegraph poles, in the upper corners of upstairs windows, between the bricks of walls—in fact,

in almost any crevice so long as it be dry, not likely to be flooded by winter rains and six feet or more above the ground. It emerges from its snug hiding-place on a bright warm day, just as spring is giving

place to summer, and after a short period spent in exercising its wings and feeding, it seeks a mate and weds. After mating the male Two-Spot has performed its allotted task, and after a brief period spent in flying and feeding it dies. The female lays her eggs upon the leaves (Fig. 1), branches, or trunks of trees, or even on the garden palings. She is not endowed, as has often been stated, with an instinct which enables her to choose a repository for the eggs where there will be a food supply of aphids for the young larvae, for she understands no more than man does the why and wherefore of the coming and going of the aphides. Mrs. Two-Spot has even been known to lay her eggs upon a stone by the roadside. The eggs or ova are laid in batches of from eight to twenty-five or even more, and the period of incubation is from five to ten days, according to the weather.

In laboratory experiments it was found that this period could be shortened by increasing the temperature and prolonged by reducing it, within certain limits, of course. It is from the moment of hatching that the life-history becomes extremely interesting and, for the experimenter, very difficult.

Immediately upon hatching the tiny larva turns and eats a portion of the shell of the egg it has just left. This seems a curious proceeding, but its next proceeding is more curious still for it immediately sets to work to eat up its nearest brother or sister and,



FIG. 1.
EGGS OF THE TWO-SPOT LADYBIRD ON THE BACK
OF A ROSE LEAF.

As in this instance, they are often found near the leaf margin and are also laid on branches or trunks of trees.



FIG. 2.
A LADYBIRD LARVA.
(Magnified about seven times).
In this stage it is most beneficial to the plant grower since it feeds largely upon green-flies.

off the green-fly at the rate of from thirty-five to forty-five in an hour, so that twenty-five Two-Spot larvae will account for about one thousand green-fly in an hour. The larvae passes through four periods or stages called "instars," and is then fully grown; except for a short period between these stages when it is quiescent while changing into a new suit, it is hard at work destroying aphides. It is in this larval stage that its work is most beneficial to the agriculturist, though after it becomes a perfect insect it still feeds upon aphides. The ways of aphides are not yet fully understood; one may find a bush covered, yet not many hours later, though there may have been no apparent change in the weather, there is not an aphid to be seen. This has been noted time and again when seeking food for larvae bred in the laboratory. Now the larvae can neither travel far nor fly to another bush when the aphides vanish, so when this happens they immediately resort to cannibalism. It is this habit of cannibalism together with the uncertainty of the appearance of aphides which make the work of experimental breeding so hard. To get over the difficulty of cannibalism the breeder must separate the young larvae at the time of their dispersal and keep each in a small glass-topped box alone. This means that a large number of boxes have to be looked after and to be provided with food daily, if three or four families are being bred, but it is the only safe way of avoiding a tremendously heavy mortality. Perhaps the only time when aphides are welcome on the rose bushes in the garden is when their owner has such a family as this to rear and feed. But it is a common mistake to think that the Two-Spot only finds its food upon the rose trees. There are many plants which are troubled each with their own species of green-fly, and there is one of these

what is more, it begins its meal near the tail end and eats towards the head of its victim without first killing that victim. The survivors of this cannibalistic feast then immediately scatter, as though in distrust of each other, and begin at once their important mission in life, the destruction and eating of green-fly. The larva (Fig. 2) is of a slaty grey colour diversified by raised, coloured spots, and it has six legs upon which it travels much more nimbly than the larvae or grubs of most beetles can do; it can polish

upon which the breeder is almost always sure of finding aphides—the beech tree. Fortunately the Two-Spot is rather catholic in its tastes, and will thrive very well upon the beech aphid.

Cannibalism is characteristic of some other species of ladybirds, and the habit of making the first meal of part, never all, of the egg shell seems also to prevail with most species. There must be some biological reason underlying both these habits, for if the young larva be prevented from eating its egg shell it dies, and if the batch be separated before that first cannibalistic meal they all die. It may be that as the mother ladybird cannot foretell the presence of aphid at the time when her progeny will hatch out, or that the habits are another such wise provision of Nature as that of the seed being provided with sufficient nourishment for the growth of the young plant until it can fend for itself; and these first meals may just provide the young larva with the requisite strength to enable it to travel in search of its food.

Having reached the end of its fourth instar the larva attaches itself by a part near the tail to a leaf—sometimes it is the front of the leaf, sometimes it is the back, but in either case it is most often near to the midrib. Here, with a portion of the larval skin still adhering to it, it turns into a pupa (Fig. 3). The larval portion of its life has occupied from sixteen to twenty-four days, and it remains in the pupa case for about nine days and then comes forth as a perfect Two-Spot ladybird. Both the larval and pupal stages may be hastened or lengthened in the laboratory by raising or lowering the temperature.

Only a small proportion of the ova deposited by the mother ladybird ever reach the imago or perfect stage in the course of breeding experiments. There is usually heavy mortality in the larval stages from one cause or another, and sometimes from no discoverable cause. If the breeder brings fifteen per cent of the ova through successfully, he has had a good result, and probably the percentage under outdoor natural conditions is smaller than this. In breeding, great care must be taken to open each box at least once a day for airing. The time taken to change the food supply suffices for this, but if this be not attended to a tiny mould collects which is immediately fatal to the larvae in all stages.



FIG. 3.
PUPA OF LADYBIRD.
(Magnified four times).
Seen to the right on the back of a leaf near the midrib, with a larva on the left.

From the laying of the egg to the emergence of the imago occupies on an average thirty-four days and, though the time of leaving winter quarters varies with the season, the progeny of the hibernated parents reaches perfection, in a normal year, some time in June or July. Where the season is earlier the emergence will, of course, be earlier. These imagoes have but a short season of life: they pair, deposit their ova, and may not afterwards live long to enjoy their freedom. The ova hatch out and the life cycle goes on again with the perfect insects emerging in August or September. These, after feeding awhile, go into hibernation to perpetuate the species in the following year.

Although the larvae of the ladybird cannot travel far in search of food the imagoes can and sometimes do. In fact, when an imago has emerged from the pupa case, the air has hardened its wing cases, and it has developed its colours and tried its wings—events which occupy about an hour—it immediately leaves the bush upon which it has emerged and finds another upon which to feed. This is probably also an instinct that prompts it to leave the aphides upon that bush to be devoured by the larvae still at work, since they cannot fly as it can.

When the weather is warm and fine and aphides are unusually abundant, the ladybird larvae seem to get through their larval and pupal stages much more quickly than usual, and larval mortality is not so great, probably because of the abundance of aphides. Then the imagoes occur in great swarms, and it is in such favourable seasons that migrations take place. Over and over again swarms of Two-Spots have apparently crossed the Straits of Dover from France. Thousands of these, which perhaps flew too low down and were caught by the waves, have been washed up upon our south-east coasts. Vast numbers have settled in the hop gardens of Kent, and Sussex, and Surrey, and in fact, in the year 1869 such a swarm came over that there was not room for them in the hop gardens, and clouds of these insects appeared in London, swarming on pavements, roads, and walls. People were superstitious about these swarms at one time, and there is on record the visit of a swarm to Reading which so alarmed the inhabitants, who regarded it as portending some evil, that the fire engines were called out to repel the invasion with water in which tobacco had been soaked.

Scientists divide the ladybirds into species partly according to the number of spots upon the elytra (wing cases). The Two-Spot, for instance, is so called because the normal form has a black spot upon the centre of each elytron, although it is not always true to its name, for varieties may be found in which the elytra show many variations of spotting from the two black spots on a reddish ground to specimens which are all black. The Seven-Spot ladybird, called the "lady cow" in the north country, is larger and has three spots on each wing case and one where these cases join. There is also a Five-Spot, a Ten-Spot, and an Eleven-Spot. In some of these, however, the number of the spots varies very considerably, and this is particularly the case in the Two-Spot and in the Ten-Spot (Fig. 4: 1 and 2), the latter varying so much that it has been named "variabilis." Apart from the number of spots, the only outstanding difference between these two species is the colour of the legs, which are black in one species and pale yellow in the other. The life-history and habitat of the two are almost identical, and it has been proved recently that a member of one species will readily mate with a member of the other species. In fact, a form which has long been known to coleopterists and has always been classed as a variety of the Ten-Spot, has recently

been discovered to be a natural hybrid, the result of the mating of a female Two-Spot with a male Ten-Spot (Fig. 4: 3). This hybrid, which has been named *Coccinella biabilis*, occurs wherever the two species are found together, and in some areas it is fast becoming much more common than either of its progenitors. It has been proved by experiment to be more prolific and adaptable to climatic conditions; it is also more destructive of green-fly than either of its original parents, and for this purpose should present greater possibilities to agriculturists. Here we probably have a new species in process of development, and one which is gradually ousting those from which it sprung, at any rate in the more extreme climatic areas.

In conclusion it may be mentioned that in conjunction with Mrs. Merritt Hawkes, D.Sc., the writer has during the past few months discovered and worked out the life-history of another ladybird which has puzzled naturalists ever since Linnaeus first named it in 1857; and it is hoped to publish an account of it very shortly in *Discovery*.

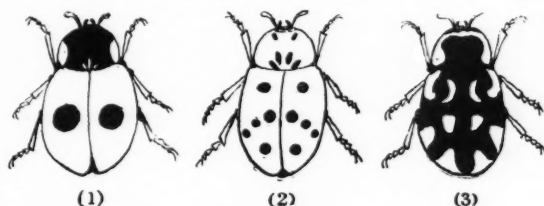


FIG. 4.

THE TWO-SPOT LADYBIRD, THE TEN-SPOT AND THE HYBRID FORM.

Typical forms of (1) the common Two-Spot Ladybird; (2) the Ten-Spot; and (3) a hybrid form which it has just been discovered originated from the mating of a female Two-Spot and a male Ten-Spot. The lunar spots are its chief characteristic, in other respects it resembles sometimes both parents, sometimes one or the other.

London in Literature.

Links with the Past.

Even those of us who are town dwellers seldom appreciate the interesting links that survive in the ancient City of London with the greatest of our masters in verse and prose. The scene of Christmas revels in which Shakespeare may have taken part can still be visited.

IN the Temple of the lawyers, quietly secluded from the roar of Fleet Street's traffic, stands the finest of the Elizabethan halls that have survived, linked with the greatest name in our literature. "Twelfth Night" was played in Middle Temple Hall in Shakespeare's lifetime. The occasion was the Christmas masque, or feast, of the barristers and students of the Inn of the year 1601. It was not, apparently, actually the first performance, for the play is believed to have been presented at Whitehall for the delectation of Queen Elizabeth and her court at Christmastide, probably on Twelfth Night itself, a customary time for hilarity. It was then fresh from the dramatist's pen.

John Manningham, to whom we owe our knowledge of the performance, found it new. A student of the law, he had just entered Middle Temple, and he was present. Under date the 2nd February, 1601-2, he records that fact in his diary. It is interesting to read his somewhat naïve criticism committed to the diary, which to-day is among the vast collection of Harleian Manuscripts in the British Museum; for he is the earliest critic whose judgment has come down to us of this last of Shakespeare's joyous comedies.

"At our feast (he writes) we had a play called Twelve Night, or What You Will. Much like the Comedy of Errors, or Menechmi in Plautus; but most like and near to that in Italian called Inganni. A good practise in it to make the steward believe his lady widdowe was in love with him, by counterfeiting as from his lady in general terms, telling him what she liked best in him, and prescribing his gesture in smiling, his apparel, etc., and then when he came to practise, making him believe they took him to be mad."

Was Shakespeare himself among the company of actors? It has often been so surmised, and the tale has been told in Middle Temple Hall, but that is unlikely. Young lawyers were active supporters of the Elizabethan stage; they fancied themselves as Thespians, and not only did they produce their masques and plays, but themselves acted them. It was some lawyer Malvolio who strutted the boards here, as foil of the "good practise" that won John Manningham's commendation. The Temple's Christmas revels figured as an important event in the legal calendar. It is no far-stretched supposition

that Shakespeare, living in London at the time, was seated among the audience, come to watch what the lawyers did with his play, and maybe with disapproval.

Guildhall possesses a treasure which rightly it regards as priceless. Shakespeare's own signature is there upon a deed. It is kept in the Museum under glass, and is further protected by a curtain that has to be raised for inspection. In Carter Lane, close by St. Paul's, a tablet marks where stood the Bell Tavern, from which in the year 1598 Richard Quynney directed a letter "To my loveing ffriend and countreyman Mr. Wm. Shackspere deliver these," the only letter addressed to the poet that is known to exist. The original is at Stratford-on-Avon. But London has few links with Shakespeare that it can show. Ireland Yard at Blackfriars, where his property stood, is a name. The "wooden O" that served in his day for a theatre, the boarded platform supported on trestles of the inn-yards, around which the groundlings gathered—these by their nature could not long outlive his time.

Whitehall itself has gone. Middle Temple Hall is the last of Shakespeare's stages that survives—the same wide-spreading hammer-beam roof, and panelled walls and minstrels' gallery that he will have known; it was almost new then. And it is most fitting that the association should be here, for the Temple is full of literary memories.

Oliver Goldsmith.

IN Brick Court, Temple, a little paved space where the lane from Sir Christopher Wren's great gateway descends to the riverside, stands the house in which Oliver Goldsmith lived the last six years of his troubled life, and worked and died. He had come to Brick Court in 1768, well stored with money for once in his penurious life, for his comedy "The Good-Natured Man," after it had been refused by Garrick, brought him £500 on production at Covent Garden Theatre. Four-fifths of this sum was spent—wisely for once—in acquiring a life lease of these Temple chambers, and the balance no doubt was quickly squandered. He wrote there "The Deserted Village."

You may climb to-day by the stout staircase to the suite of rooms on the second floor. They are still as Goldsmith left them, having been treated with the greatest care by successive legal occupants. The house is No. 2 in the court, and no difficulty occurs in finding the lodging, for the Society of Arts has placed a sculptured plaque on the exterior wall. Goldsmith had been but a little while in Brick Court when he began "The Deserted Village." This we know from a reminiscence of his time. He was no rapid worker, and only the goad of want drove him from his natural indolence. A lawyer friend and fellow templar, Cooke, chanced to call upon him when two days' progress had been made with the poem, and Goldsmith proudly pointed to ten lines (fifth to fourteenth) as the morning's output. No more work was done that day, the incursion of a friend being judged sufficient excuse for a ramble into the country, or what Goldsmith himself described as "a shoe-maker's holiday." Before their departure he had read the lines aloud to his guest:—

"Dear lovely bowers of innocence and ease,
Seats of my youth, when every spot would please,
How often have I loiter'd o'er thy green,
Where humble happiness endeared each scene!
How often have I paused on every charm,
The shelter'd cot, the cultivated farm,
The never-failing brook, the busy mill,
The decent church that topp'd the neighbouring hill,
The hawthorn bush with seats beneath the shade,
For talking age and whispering lovers made."

Apart from this poem, which many good judges still hold to be the best of Goldsmith's, there is difficulty in tracing what part of his output originated in the Temple, for when publishers pressed him for manuscripts overdue he often went to a farm lodging he had taken at Hyde, near Edgware, to separate himself from London friends and London distractions.

*

They are small rooms, with characteristic Georgian panelling, the door-cases and cornices decorated with excellent carving. Of pathetic interest is the tiny chamber in which Oliver Goldsmith died, a stuffy space boxed round, just giving accommodation for a small bed and with no direct access for light and air. Thackeray, who later was a tenant of the same house, wrote to Forster, Goldsmith's biographer:—

"I was in Goldsmith's chambers in Brick Court the other day. The bedroom is a closet with no light in it. It quite pains one to think of the kind old fellow dying off there. There is some good carved work in the rooms; and one can fancy him with General Oglethorpe and Topham Beauclerc, and the fellow coming in with the screw of tea and sugar. What a fine picture Leslie would make of it!"

Goldsmith is buried in the fragment of the Temple Churchyard, beneath a coped stone which bears only the words "Here lies Oliver Goldsmith," and the dates of birth and death. Often, too, it bears a wreath of flowers, testifying that he is not forgotten. He was but forty-four.

Crown Office Row, not many

paces distant, is another Temple shrine. Its length has been mostly rebuilt, but among the few of the older houses preserved is that in which Charles Lamb was born. His father was clerk to Mr. Salt, a barrister, and had rooms there. Literary fame came to him long after the family's departure from Crown Office Row, and his other Temple homes in Mitre Court and Inner Temple Lane have been destroyed, but no one has written more charmingly than Lamb about the Temple and its occupants, or has loved London better. Listen to the Londoner in him, in a letter to Robert Lloyd:—

"Let them talk of lakes and mountains and romantic dales—all that fantastic stuff; give me a ramble by night, in the winter nights in London—the Lamps lit—the pavements of the motley Strand crowded with to and fro passengers—the shops all brilliant, and stuffed with obliging customers and obliged tradesmen—give me the old bookstalls of London—a walk



MIDDLE TEMPLE HALL.
From an early nineteenth-century engraving.

in the bright Piazzas of Covent Garden. I defy a man to be dull in such places—perfect Mahometan paradises upon earth! I have lent out my heart with usury to such scenes from my childhood up, and have cried with fullness of joy at the multitudinous scenes of Life in the crowded streets of ever dear London. I wish you could fix here. I don't know if you quite comprehend my low Urban Taste; but depend upon it that a man of any feeling will have given his heart and his love in childhood and in boyhood to any scenes where he has been bred, as well to dirty streets (and smoky walls as they are called) as to green lanes, 'where live nibbling sheep,' and to the everlasting hills and the Lakes and ocean. A mob of men is better than a flock of sheep, and a crowd of happy faces jostling into the playhouse at the hour of six is a more beautiful spectacle to man than the shepherd driving his 'silly' sheep to fold."

In the baptismal register of Allhallows, Bread Street, happily preserved when the Great Fire of London destroyed the church, you may read this:—

"The xxth day of December, 1608, was baptized John the sonne of John Milton the scrivener."

This brief entry and the grave in St. Giles Cripplegate Church are the only remaining links with her great poet that London may claim; save, of course, the knowledge that his chief works were written in London. He was born in Bread Street, off Cheapside, and in a long life had many London houses of lodging. One of these, in Aldersgate Street, he has commemorated in a familiar sonnet. The time was the outbreak of the Civil War, a fortnight after Edgehill, when King Charles I's army was approaching London, but was stopped at Turnham Green by the imposing array in arms of the citizen forces standing there for the Parliament.

In half jesting mood, Milton implores the Royalist captain or colonel whom victory might bring into Aldersgate Street to spare the poet's home, as Alexander had spared the house once inhabited by Pindar—

"Captain, or Colonel, or Knight in Arms,
Whose chance on these defenceless doors may seize,
If deed of honour did thee ever please,
Guard them, and him within protect from harms.
He can requite thee; for he knows the charms
That call fame on such gentle acts as these,
And he can spread thy name o'er land and seas,
Whatever clime the sun's bright circle warms.
Lift not thy spear against the Muses' bower:
The great Emathian conqueror did spare
The house of Pindarus, when temple and tower
Went to the ground; and the repeated air
Of sad Electra's poet had the power
To save Athenian walls from ruin bare."

London in literature has no more persistent figure than Samuel Johnson. Though denied the birthright, and a Lichfield man, he is the Londoner par excellence, by long association and by love of our city. "When a man is tired of London he is tired of life, for there

is in London all that life can afford"—only a true lover could have said that. Johnson had many homes in and about London City, but save Staple Inn, which sheltered him for but a short spell, and Gough Square, where a much more important period of his life was spent, the pick-axe of the housebreaker has destroyed them all.

Gough Square lies at the back of Fleet Street, amid the great printing houses. Johnson came there in 1748, with the contract for writing the "Dictionary of the English Language" in his pocket. That work was to have been completed in three years. Actually it occupied him for eight years; and the fee of 1,500 guineas being spread over that time, during the whole of which he had to pay his amanuenses, it is difficult to see how he can have got anything at all for his labour. The house stands, thanks to the liberality of Mr. Cecil Harmsworth, who purchased, restored, and made a Johnsonian museum of it at a time when the City Corporation had threatened to have it pulled down as an unsafe structure.

It is stout, old-fashioned, oak-balustrated still, as it was when Carlyle in 1832 paid a memorable visit there. Only the "plot of delved ground somewhat larger than a bed-quilt" has been covered by a cottage built for the custodian. Every room is of interest, this being the home wherein Johnson spent eleven years, but most people ask first for the long, low garret, with its sloping roof. There the



SAMUEL JOHNSON'S HOUSE IN GOUGH SQUARE.

Dictionary was compiled, and it is not difficult to reconstruct the apartment as Boswell has described it, "fitted up like a counting-house," with rough desks for the copyists. May be no one ever consults Johnson's Dictionary nowadays—in scope and scientific precision we have gone far ahead of it—but many a bon-mot that has not lost its savour is to be found among the definitions:

"*Oats*. A grain which in England is generally given to horses, but in Scotland supports the people."

Commonly the last words are mistranscribed "supports men," to justify the Scotsman's rejoinder, "And where else do you find such horses, and such men?"

"*Excise*. A hateful tax levied upon commodities, and adjudged not by the common judges of property, but wretches hired by those to whom Excise is paid."

"*Lexicographer*. A writer of dictionaries, a harmless drudge."

"*Patron*. Commonly a wretch who supports with insolence and is paid with flattery."

"*Pension*. An allowance made to anyone without an equivalent. In England it is generally understood to mean pay given to a state hireling for treason to his country."

"*Favourite*. One chosen as a companion by a superior; a mean wretch whose whole business is by any means to please."

"Patriotism is the last refuge of a scoundrel," a phrase still often quoted, is not in the Dictionary. In addition to completing that portentous work, Johnson wrote at Gough Square *The Rambler* during the two years of its publication, a curious little sheet that appeared twice each week. "Rasselas," too, is claimed for this house, on the evidence of a letter addressed by Johnson to Lucy Porter, his step-daughter, but that claim Staple Inn hotly contests.

One by one literary landmarks in the old City of London of the Lord Mayor's jurisdiction have been fast disappearing. The process was inevitable when always the demand is made for more and more tall office buildings. Thirty years ago Samuel Richardson's house in Salisbury Court was still standing, wherein he had written "Pamela," and some years later died, but that has given place to a great newspaper office. But of late years, almost unexpectedly, we have had one conspicuous figure restored. When searching through the baptismal register of St. Bride's Church in Fleet Street, Mr. Walter Bell came upon this entry:

"March 3, 1632-3. Samuel sonn to John Peapis, wyef Margaret."

It proved beyond further dispute that Samuel Pepys was a Londoner by birth, and not merely by life-long residence and adoption, and now there is a plaque placed on the house in Salisbury Court that covers the site whereon had stood till the Great Fire the house of John Pepys, the diarist's father. Brampton, near Huntingdon, before had claimed him. There has been no recent discovery of a literary



THE TOWER OF ST. BRIDE'S CHURCH IN FLEET STREET.

character more interesting than this. Of course, London has been the birthplace of many more great literary figures than have had mention, but no link with them remains in the much-changed face of the City. Chaucer himself was born in Thames Street, Herrick over his father's shop in Cheapside, Pope in Lombard Street, Defoe at St. Giles Cripplegate, Gray in Cornhill, Sir Thomas Browne, of the "Religio Medici," in the Cheapside parish of St. Michael-le-Quern, and Keats in Moorfields.

These alone should make a galaxy for the old City of London, a starry firmament such as no other city or town can rival. But there is one other sweet singer whose name gives added lustre to London's roll of fame—Edmund Spenser, who first saw light in East Smithfield, by the Tower. In his "Prothalamion" he writes affectionately of his birthplace:—

"Merry London, my most kindly nurse,
That to me gave this life's first native source,
Though from another place I take my name."

J. C. K.

The Science Museum.

THE general public has hitherto had little opportunity of making acquaintance with progress in modern physical research, since the published reports are for the most part too technical for the non-specialist reader. In consequence, the authorities of the Science Museum at South Kensington are now arranging a series of popular exhibitions, and a beginning was made last month, when apparatus and material were on view relating to research lately carried out by the National Physical Laboratory at Teddington, in the departments of metallurgy, engineering, and physics.

The Romance of Romani.

By Dora E. Yates, M.A.,

University Library, University of Liverpool.

In reviewing Dr. Sampson's latest book on the Gypsies, Miss Yates describes how its author when on a caravan tour in Wales made the great discovery that the ancient Romani tongue—a pure Indian language—is still preserved there by a clan of these people. This has shed new light on their romantic history.*

THE study of the Gypsies—that mysterious people who, after an uneventful and barely chronicled† sojourn in the Byzantine Empire for over three hundred years, suddenly overflowed every country of Europe in the early fifteenth century—is one which abounds in discoveries. Popular tradition held them to be Egyptians, condemned to a seven years' pilgrimage in penance for having refused hospitality to the Virgin Mary and Infant Saviour,‡ a belief evidently shared by that quaint comparative ethnologist Andrew Boorde in his early account of this people (1547):—

"Egipt is a countrey ioyned to Iury; The countrey is plentyfull of wine, corne, and Hony. Ther be many great wyldernes, in the which be many great wyld beasts. In the which wildernes liuid many holy fathers, as it apperyth in *vilas patrum*. The people of the countrey be swarte, and doth go disgisyd in theyr apparel, contrary to other nacyns: they be lyght fyngered, and vse pyking; they haue litle maner, and cuyll loggyng, and yet they be pleas(a)unt daunsers. Ther be few or none of the Egipcions that doth dwell in Egipt, for Egipt is repleted now with infydele alyons. There mony is brasse and golde. Yf there be any man that wyl learne part of theyr speche, Englysche and Egipt speche foloweth"

* "The Dialect of the Gypsies of Wales." By John Sampson, Hon. D.Litt. (Oxon). (Clarendon Press, 1926. Pp. xxiv + 652. 84s. net).

† The first authentic reference to Gypsies in Europe is that given by a Georgian monk of Mt. Athos, who, writing about 1100, describes the *Atsincan* as descendants of the Samaritan race of Simon Magus, "wizards and famous rogues, and incidentally adepts in animal poisoning." (*Journal of the Gypsy Lore Society*, Third series, ii, 167; quoted in French translation by Miklosich, *Mundarten*, vi, 60).

‡ So Wursten in the *Basler Chronik*, 1580. According to another chronicler, however, Corner of Lübeck, *Chronica novella* (*usque ad 1435 deducta*) "the cause of their wandering life was their infidelity to the Christian faith, and their relapse to paganism after a first conversion." (Bataillard: "Immigration of the Gypsies," *J.G.L.S.*, Old series, i, 275, 337).

Follow it does. But it was not until the "Boke of the Introduction of Knowledge"* had been reprinted for the second time (in 1870), that Dr. Zupitza, of Vienna, made public the discovery that these specimens of "Egipt speche" were excellent Romani, collected from English Gypsies.



[Photos by Fred Shaw, Friern Barnet.
CAROLINE WOOD, A FAMOUS WELSH GYPSY FORTUNE-TELLER
The clan of Welsh Gypsies discovered to be still speaking the Romani tongue of 200 years ago are the descendants of an eponymous ancestor Abram Wood.

Much later, in the last years of the eighteenth century, with the publication and translation of Grellmann's "Dissertation on the Gypsies: being an historical inquiry concerning the manner of life, oeconomy, customs, and conditions of these people in Europe, and their origin" (1787), and the repeal of many of the cruel and barbarous statutes which made Gypsy birth a penal crime, there sprang up a newly-awakened interest in this strange race. Their language began to be scientifically studied and, as a result, three scholars arrived almost

simultaneously at the conclusion that the Gypsies must be an Indian people speaking an Indian tongue. This discovery has hitherto been commonly attributed to Rüdiger (c. 1782) or Grellmann (1783); but Dr. Sampson by a process of exact reasoning has now assigned the precise date to the collection of Jacob Bryant (12th August, 1776, at Windsor Castle), and has therefore proved that it is the Englishman rather than either of the Germans who was the first to demonstrate the Indian origin of the Gypsies.

A decade or two later, with the discovery of Sanskrit, and the broad generalizations which followed Friedrich

* "The Fyrst Boke of the Introduction of Knowledge," chap. xxxviii, pp. 217-8. (Early English Text Society, Extra series, No. X).

† *Journal of the Gypsy Lore Society*, New series, iv, 168.

Schlegel's "Weisheit der Indien" (1808), and made it possible to group all Aryan languages as branches of a single family, came a further development of knowledge—the birth of the science of Comparative Philology. Adelung, Pott, Ascoli, and Miklosich all threw themselves with zest into the pursuit of the elusive Gypsies. New dialects were collected and analysed, and specimens published of the speech of the Hungarian Tzigané, the Zincali of Spain, the Tchingianés of Turkey, and the Transylvanian, Slovakian and German Zigeuner.

In our own islands this ancient tongue was supposed long ago to have degenerated into a mere jargon—the type of Anglo-Romani made familiar to us by the works of George Borrow. The "Dialect of the English Gypsies" (1874) compiled by Dr. Bath Smart and H. T. Crofton certainly gives "a tolerably complete exposition . . . of the deepest extant English Romanes" hitherto collected; but at the same time the editors are obliged to confess that the "paucity of roots in the English Gypsy vocabulary," and the absence of many words common to Continental dialects, necessitate the use of clumsy periphrases, while their specimens avowedly illustrate not only the loss of case-endings and verbal inflections, but "numerous violations of every grammatical rule." From the day of Smart and Crofton's Gypsy instructor, Sylvester Boswell (who himself had occasional lapses into "very dog-Romanes") this process of deterioration has continued, until Anglo-Romani may be truly said to have become little better than a sort of Cant, with limited vocabulary, and none but English inflections.

It was at this stage that Dr. Sampson, a student of the various Continental dialects of Romani, and himself a master of all that "Wester" and the English Gypsy pundits had to teach, made his great discovery. Travelling on a caravan tour through Wales, he chanced upon a Welsh Gypsy harper at Bala, and found that the ancient Romani tongue of two hundred

years ago was not only preserved in all its perfection in Wales, but was the mother-tongue of a large clan, descendants of an eponymous ancestor Abram Wood, who entered the Principality at the end of the seventeenth century. The miracle of finding a pure Indian language spoken in the heart of Wales is explained by the fact that this tribe have kept their dialect religiously intact, and use the vernacular (English or Welsh) only when conversing with the Gajé or Gentiles.

The result of Dr. Sampson's labours, the collections of over thirty years—"gathered in every part of Wales where members of the clan [of Wood] were to be found . . . from harpers, fiddlers, fishermen, horse-dealers, knife-grinders, basket-makers, wood-cutters, fortune-tellers and hawkers"—has now been given to the world, and an epoch-making work it is.

Its modest title disguises the fact that here, for the first time in English, we have a comprehensive work on Comparative Gypsy Philology, where Romani is at length assigned its true place in the group of modern Indian languages. In Chapter III the development of Romani from Sanskrit and the Prākritis, which throws a flood of new light on the origin of the Gypsy tongue, Dr. Sampson

emphasizes the extremely early date at which Romani broke away from the original stock. Beames* dates the rise of the Indian vernaculars in their present analytic form about the eleventh century, the earliest Hindi poem of the modern period being the "Prithirāja Rasan" of the "morning-star of song," Chand Bardāi. But the Gypsies first step definitely into history in the Shāh Nāmē of the poet Firdausi (*obit* 1024), who refers to them as Luri, and relates that they are the descendants of some 10,000 Indian minstrels imported into Persia for the amusement of his subjects by the Sassanian monarch Bahram Gur (the "great hunter" of Omar's



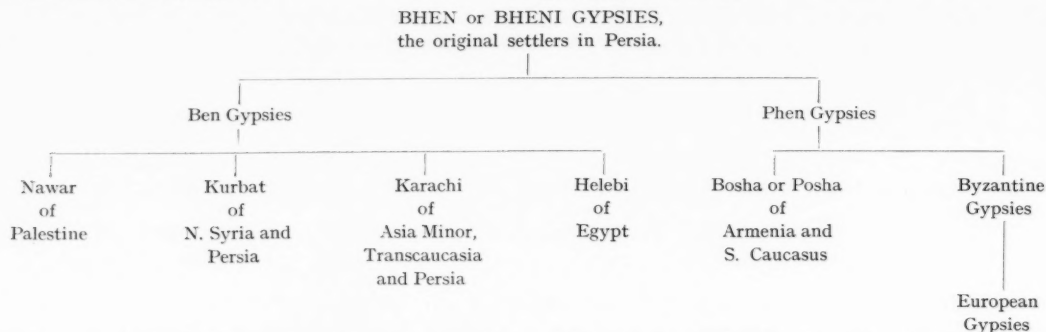
MATTHEW WOOD, STORY-TELLER, ANOTHER MEMBER OF THE WELSH GYPSY CLAN.

Members of the Wood clan include knife-grinders, harpers, fiddlers, and horse-dealers.

* "Comparative Grammar of the Modern Aryan Languages of India," i, 117.

Rubaiyat). A similar account is found independently some half-century earlier in the writings of the Arabian historian Hamza of Ispahan, who terms these Gypsies "Zott," i.e., Jāt. "While this legend," says Dr. Sampson, "cannot be accepted as historical fact, the prevalence of such a myth seems to show that this people must have been settled in Persia before the beginning of the tenth century." These early Gypsies then, having abandoned their Indian home, and entered Persian territory some years before A.D. 900, were a single race speaking a single tongue—"Ur-Zigeunerisches"—which may therefore be regarded as the oldest living example of the Neo-Aryan languages, saved by its isolation from the decay which has affected the others.

regularly distinguish these two families of Romani, and by establishing the presence of identical Persian loan-words in the dialects of them both, but Armenian borrowings in Western Gypsy only, Dr. Sampson is able to prove that the *Ben* Gypsies on leaving Persia "travelled southwards into Syria and became the ancestors of the Nawar of Palestine, the Kurbat of Syria, the Karachi of modern Persia and Transcaucasia, and of the Helebi of Egypt; while the *Phen* Gypsies, after settling for a time in Armenia, migrated westwards through Kurdistan and Byzantine Greece, reaching the Peloponnesus" (as we have seen) "before the end of the eleventh century." The same facts are conveniently indicated in the form of the following genealogical chart:—*



Then by an analysis of the characteristic phonetic laws found in Eastern and Western Romani, Dr. Sampson arrives at the conclusion* that in Persia these original Gypsies, the ancestors of both the Asiatic and European *Romané* of to-day, separated into two distinct bands. These he conveniently terms the *Phen* and the *Ben†* Gypsies respectively, i.e., those who have converted the original Sanskrit-Prākṛit aspirate mediae gh, jh, dh, and bh, into kh, ch, th, and ph, and those who have de-aspirated the same sounds.

Thus, for example, the Sanskrit words gharma, "heat" and ghāsa, "pasture-grass," √ dhāv, "to cleanse" and bhrātr, "brother" have become in Armenian and European Gypsy kham "sun," khas "hay," thov- "to wash," and phral, phal "brother," while in Syrian Gypsy (or Nuri) they appear as gam, gas, dau-, and bar respectively.

By adducing numerous examples of this sound change, and other constant phonetic differences which

The route followed by the Gypsies in their wanderings among various peoples after their exodus from India, and even "the length of their stay in any particular region" which they made their temporary

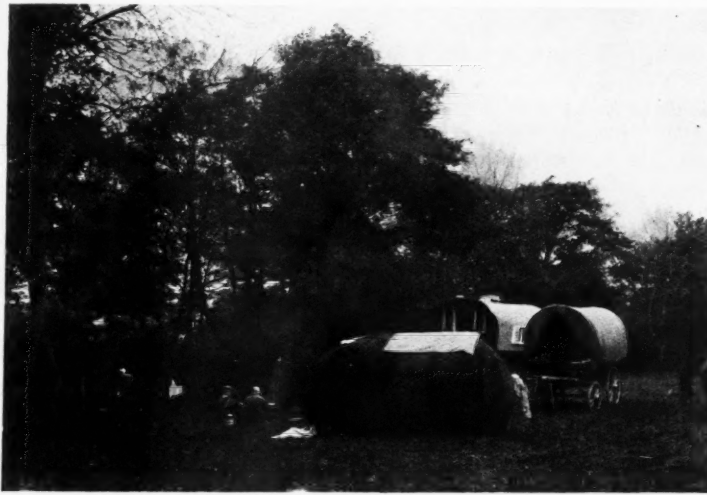
* Reprinted, by permission, from the *Journal of the Gypsy Lore Society*, Third series, ii, 69.



A WAYSIDE GYPSY ENCAMPMENT IN WALES.

* First announced at the Liverpool Meeting of the British Association in 1923.

† These names originate in their respective forms of the word for "sister" from Prākṛit bhāini < Sanskrit bhagini.



ANOTHER PICTURESQUE SCENE IN A WELSH GYPSY CAMP.

home, is furnished by the last, though by no means the least, interesting feature of this book, the "Classified Index of Etymons." From this we learn that the "staple of Romani, in vocabulary as in grammar, remains Indian," as may be seen at a glance, when we find that there are more than 500 words of Sanskrit origin in the speech of the Welsh Gypsies.

The strange vicissitudes that words undergo is nowhere more apparent than in Romani, where we meet with such transformations as Sanskrit *vyaṅga* "limbless," "a cripple," "a frog" turning into the *beng* or "devil" ("a sense probably originating in the rude painted representations of St. George on horseback slaying the dragon which . . . the Gypsies must have everywhere met with on their entry into Grecian territory"); the venerable "rishi" of the Vedas transposed into the *rashai* or parish parson of to-day; the Indian *chūdā*, "tuft of hair left on the crown after tonsure," becoming the *chōrn* or "curls" of some dark Gypsy *chai*; while the *triśūla* or trident of the god Śiva has been degraded into a mere cross—even that on a donkey's back—or "a Gypsy trail left on the road to indicate to stragglers the route taken by the leaders of the band."

The presence of fifty-four Iranian words in Welsh Gypsy—among them three of undoubted Arabic origin, *viz.* :—

bērk "bosom," *kaṭūn* "linen," and *kisi* "purse," and at least eight Armenian, *viz.* : *bov* "oven," *dudum* "melon," *chikat* "forehead," *chovexano* "wizard," *kotor* "piece," *kochak* "button," *mortsi* "skin," and *grast* "horse"

argues a prolonged stay in Persia until some time after the Arabic conquest, and a somewhat shorter sojourn in Armenia; while the Gypsies' passage westward is attested by the survival of such Kurdish and Ossetian loan-words as *Xulano*, landlord, *dosh-* to milk, and the universal *verdo* or *vordon*, "caravan."

The interesting and significant word *manzin*, "treasure," the true etymology of which is here given for the first time, "must have been picked up from the Seljuk Turks on the passage of the Gypsies through the Asiatic provinces of the Byzantine Empire, about the eleventh century; unless indeed it be a later acquisition from the Mongol invaders of Hungary and Bulgaria under Ogdoi Khan in the early thirteenth century."

In Grecian territory, before their immigration into Western Europe, the Gypsies' borrowings were numerous and of great importance, including such familiar words as :

drom "road," *fōrus* "market-town," and *velgōra* "fair"; *chēros* "time," *ōra* "hour," and *kurko* "week"; *jamba* "frog," *kaka-rachka* "magpie," and *papin* "goose"; *krashi* "cherry," *kokalo* "bone," and *zumin* "soup"; *kekavi* "kettle," *krafni*

"nail," *petalo* "horseshoe"; *misali* "table," and *skamin* "chair"; *īza* "clothes," *chora* "coat," and *slādi* "hat." To this large common store Welsh Gypsy has now added the rare words, *ravnos* "heaven," also in English Gypsy (Modern Greek *οὐρανός*), *dūrika* "dozen" (M. Gk. *δέδεκα*), *zilvas-*, "to envy" (M. Gk. *ζῆλος*), *lutria* "scullery" (M. Gk. *λουτρόν*), *butsa* "ball" (M. Gk. *μπόρσα*), *roxer-*, "to geld" (M. Gk. *ῥῆξις*), and *smaura* "raspberry" from (M. Gk. *σμέουρον* or Rumanian *smeura*).

The considerable number of Slavic loan-words in every European dialect of Romani proves that the ancestors of our modern Romani-chals must have dwelled for many years among Bulgarians, Serbs, and Czechs before the exodus; and the Vice-Consul of Varna a few years ago was struck with amazement to hear suddenly proceeding from the lips of an old Gypsy in a tiny Welsh mountain village such pure Slavonic borrowings as *kirchimaris*, "inn-keeper" (Serb. *krčmar*), *mazos*, "frost" (Bulg. *mraz*), *pokonyos*, "magistrate" (Czech *pokojný*), and *zelano*, "green" (Bulg.-Serb. *zelen*). Of equal interest (though much fewer) are the words the Gypsies owe to Rumanian and the Romance languages, especially their name for "tent," *zigaira*, connected by Dr. Sampson with Low Latin *tugurium*, *tegurium*—a conjecture supported by a quotation from the *Peregrinatio* of Bernhard von Breydenbach (1486), where the reed-covered huts of the Gypsies of Modon in the Morea are referred to as "*tuguria*."

The debt owed by Romani to German and Modern French is far less considerable, though here too some new words and etymologies must be noted in Welsh Gypsy, *viz.* :—

mūza "porridge" (German *Muss*), *prexto* "dainty" (German *prächtig*), *shumbaria* "small beer" (German *Schaumbier*),

fuzhàra "fern" (French *fougère*). and *belìgogos* "navel," Provençal "ombelic." Finally—though these, as Dr. Sampson tells us, should be placed in a different category—come the vernacular borrowings, which, however, preserve many obsolete or dialectic words of great interest, e.g., *herimentos* "wizard" (obs. Eng. "heremite"), *hufa* "cap" (obs. Eng. "houve"), *bunèla* "cider" (dial. "bunnell"), and *mekok* "devil" (Eng. "Magog").

The grammar of Welsh Romani—the "true criterion of relationship" between it and the original stock from which it derives—is Indian in both inflection and syntax, as is fully demonstrated by the paradigm of the noun with its eight cases, all with distinct usages, and the conjugation of the verb with its six personal endings and interesting tense-formation. The following table of the present tense of the verb substantive will illustrate the antiquity of Romani, and its wonderful preservation of old Indian forms lost in the other modern Indian vernaculars:—

PRESENT TENSE OF IS- "TO BE."

	Welsh Gypsy.	Greek Gypsy.	Syrian Gypsy.	Prākṛit	Sanskrit.
Sg. 1	ishóm, shom	isóm	ashtóm(i)	am̐si, sm̐i, mhi	asmī
2	shan	isán	ashtūr(i)	sī, śī	asi
3	sī, shī	isī	ashti, ashta	atthi	asti
Pl. 1	ishám, sham	isám	ashtēn(i)	sma, mha	smas, smasi
2	shen	isán	ashtēs	ttha	stha
3	sī, shī	isī	ashte	santi, śanti	santi

For the uninitiated the vocabulary, with its wealth of examples illustrating every aspect of Gypsy life and lore, provides a rich and varied feast. In its pages the Romani-chals are in truth alive, and we listen breathless to the veritable talk of the tents. We hear of the founder of the clan Abram Wood, the *shel-bershengero* or centenarian with silver buttons on his green coat; of his sons and grandsons Valentine and Archelaus the famous harpers, and Jeremiaah with his three wives ("two he plagued to death and the third he married"); of "yellow" Alabaina with the "hollow voice," and Hannah who "suckled two bloodhounds" when her own babe died; of Saiforella who would carry her silver tongs and bellows on a donkey's back, and strip off her petticoat to turn it inside out at the sight of a kite in the air; and of Black Ellen the fortune-teller who would "fill her basket with silver and gold by terrifying the country-folk." We are impressed by the melancholy fate of William, who stole a sheep and was "*bichado pardal* or transported"; of Edmund who "used to mock at others and is now in a madhouse himself"; and of Adolphus, brother of Cornelius, "found frozen in the trenches" of Belgium. We enjoy the quiet contempt poured on the Gajé or house-dwellers with

their unclean ways ("only foolish gentiles and horses do any work"!) and smile at the strictures on the Welsh ("they are full of deceit! I dance with them and I play the fiddle for them, but nothing further.") To the folk-lorist the vocabulary offers an inexhaustible mine, with its numerous instances of birth and funeral rites, wedding customs and love-charms; its omens of good and bad luck and portents of weather; its fascinating accounts of hell-hounds, hedgehogs, snakes, Seven Whistlers and Seven Sleepers; and finally its extracts, tags, and links from folk-tales and its collection of riddles. From this dictionary the herbalist can add to his leech-lore, the horse-dealer cull useful hints for doctoring a *grai* before a fair, and the fisherman glean sound advice on the gentle art, e.g.:—

"Thou wilt never find a salmon in the river Alwen until the foxglove is in full bloom";

interspersed with quaint remarks typical of the Gypsy vein of humour, e.g.:—

"It would be the same with my dear God in heaven! If he were to cast his line in this river, and had not the right fly, he would catch nothing."

For the Gypsy, having no religion of his own (though staunch in his adherence to ancient laws of ceremonial purity, and birth, death or marriage customs), is frankly a pagan, not afraid of a jest about God and the devil, heaven or hell, e.g.:—

"I am not afraid of God, it is the other one I fear"; or "What should I do up there? Is not Heaven full of wind and snow and hailstones?"; or "Let God go hang! I am for the Devil and his bugle-blasts and hounds, and wine and fire and merry sport."

Open the book where we will, the wonderful series of illustrations—every sentence of which is the spontaneous utterance of some Welsh Gypsy—will prove a constant delight to our own and each succeeding age. By his unique contribution to learning Dr. Sampson has earned the gratitude of every student interested in Aryan speech, and has given us a work which, as one of our greatest philologists has said, "will surely become the model for all future writers on the life of a language as it is and was."

An American Undergraduate at Harvard and Cambridge.

By Murray Forbes.

In our second article on American universities, a Harvard undergraduate now resident at Cambridge gives some impressions of student life in his own country as compared with England. Next month Sir Arthur Shipley will write on his experiences during a tour of universities in the United States and Canada.

STEPHEN LEACOCK contends that the highest product of English university life is the "well-smoked" man. Certainly at Cambridge the undergraduate has far more opportunity to be affected by the mental balm of tobacco smoke than the distractions of a town, for Cambridge is almost monastically aloof from the hectic influences of modern life. One has space and opportunity for reflection—to strike a balance and find one's feet.

Boston's Social Life.

At Harvard different forces are at work. Cambridge, Massachusetts, where the university is situated, has excellent underground railway connexions with Boston: nine minutes, and one is on Beacon Street the centre of Boston's social life. It is easy for the undergraduate to be snapped up in a whirl of pleasant activity: luncheons, dinners, theatres, and week-ends in the country—here is much opportunity for the romantically inclined, and the Harvard undergraduate is nothing if not social.

Harvard reflects its proximity to a large city not only in the attitude of its undergraduate body, but in the general character of its surroundings. Harvard Square is one of the great centres of traffic in Cambridge; motors pass in endless and noisy succession around the subway kiosk in the centre—the very shrine of rapid transit; the whole scene is commercial rather than academic. Should you step into the "Yard," the large island of university buildings enclosed by a brick and iron wall, the impression is quite different. There are many buildings, ugly for the most part, yet some of the oldest are in the simple colonial style that seems to harmonize with the old elms which shade the grass plots widely spacing the "Yard." Here, at least, one is at a university; about these lecture halls, dormitories, and administration buildings, in spite of a dull heaviness of line, a sense of dignity, a rigid harmony prevails.

Cross the Atlantic to Cambridge, England. From the very first it is evident that it is indeed a university town and seat of learning. True, there are sports-model motors and aritidiluvian push-bikes much in

evidence, yet the impression is more of quiet narrow streets, and sober grey colleges. Chiefly, I think, there is a unique glamour about Cambridge one does not find at Harvard. The uniqueness of King's Parade; on one side the splendid Gothic chapel and screen of King's College; the white stone Library and Senate House of Christopher Wren; and even the late Victorian exterior of Gonville and Caius College, possessed yet of a stolid dignity—this is unparalleled in America. There is no exclusively academic atmosphere such as this. At times it can be approached of a moonlight night under the Harvard elms, only to have it shattered on looking towards the garish lights of the Square, as the roar of traffic breaks over one's consciousness. For Harvard does not have the isolation of Cambridge; it is too much bound up in the rush and rattle of modern high-pressure life. Cambridge, Massachusetts, does not exist because of the university, but almost regardless of it. The conditions it imposes are neither conducive to an atmosphere of learning or a definite university life. Once a student has attended his lectures—and this is definitely compulsory—he is free of all restrictions. The authorities have reserved the right to expel for certain breaches of good conduct, but on the whole, a student may go and come as he pleases. There are no proctors, motor restrictions, bounds, or rules for being in residence by twelve at night, the only survival of the proctorial system being a surly individual known as the "yard cop," who exists primarily for the protection of college property.

Discipline of Cambridge.

How different is the policy of those in authority at Cambridge, England. There the tutor acts in a strictly paternal manner; his pupils must apply to him for permission to leave the university, whether for the day, or for several nights. Should an undergraduate break a rule of more consequence than, say, the rule regarding academical dress, his tutor takes disciplinary action in conjunction with the university or college authorities. Conversely, the tutor is expected to furnish bail, or assist in safeguarding his pupils' interests whenever the occasion might

arise. It is no unusual thing, after the Guy Fawkes Rag, for instance, for a senior proctor to furnish bond worth several hundred pounds. At Harvard, students who are unwise enough to be arrested by the police are soon expelled or suspended unless an excellent excuse can be provided.

Curiously enough, although there are few rules restricting the life of the Harvard undergraduate, his course of study is more closely guarded and well-defined than the work of his opposite number at Cambridge. At Harvard, where emphasis is laid on the lecture, a strict checking of attendance hangs like the sword of Damocles over the unwary. It is most unpleasant trying to explain to a sceptical Dean why one did not attend one's last Saturday and first Monday lectures! A new era of hope for the gay week-end will be reached when a really fool-proof excuse for this is discovered.

Lectures and Courses.

Much has been written on the value of the lecture system itself, and it is not for me to venture an opinion. In America, lectures are generally better attended than at an English university, which is not surprising in view of the rules and regulations concerning them. They cover a definite "course," involving certain prescribed reading, and are the subject of frequent examinations and tests. There is no real parallel to these distinct "courses" at Cambridge.

The examinations for the various courses are held four times during the year, consisting of the "November hours," "Mid-years," "April hours," and "finals." The November and April examinations are not called "hours" for the sake of a poetical effect, but merely to denote the extent of their duration. Mid-years and finals are rather more formidable, each examination lasting for three hours. As four to six courses is the general rule, a student may take anywhere from sixteen to twenty-four separate examinations during one year.

But the worst is not yet; a system of "divisionals" is the ultimate test. The "divisionals" cover a student's "field of concentration"—that is, the main subject he has devoted his time to, such as English Literature. The Cambridge equivalent would be the English Tripos; the examination papers are quite similar. The Cambridge papers while allowing a wider choice of questions, insist upon a more thorough and closely-reasoned answer. The term "field of concentration" sounds very formidable indeed, but only this last autumn I waited for fifteen minutes in a club at Harvard, while a friend changed his "field" from "English Literature" to "History and

Literature," with a minimum breakage of "red tape"—the eternal refuge of Harvard authorities.

"Divisionals" do not come until the end of the fourth or senior year, for on success in these depends qualification for a degree. Meanwhile, the harassed undergraduate has been combating another boggy—"distribution," the process by which a "general education" is assured. This provides that a course of history, literature, science, and philosophy or mathematics be passed before a degree can be taken. Sixteen courses in four years must be passed to qualify for a degree—four "distribution," six "concentration," while six may be selected according to preference. It has been suggested that the two deities be represented by statues placed in appropriate niches in the Widener Library. Rodin's "Thinker" might do very nicely for "Concentration," while "Distribution" could be represented by a goddess with flowing cornucopia.

The British university system of passing two parts of a tripos, or two parts of two allied triposes, in three years, seems rather simple in comparison to this. The ordinary degree is even more so; there is nothing that quite corresponds to the ease and simplicity of this at Harvard. On the whole it can safely be said that there is a higher average of work done at Harvard than at Cambridge. The Cambridge system is built up of extremes suited to the scholar whose chief interest is in learning, and the "blue" who wants something beside an exquisitely coloured scarf to show for his three years at the university.

The pursuit of a Harvard degree may be seen to be no cynosure. If, at any time, a student falls short of a certain academic standard, he is placed on "probation"; and failing to better his standing, his "connexion with the university is severed," a harder fate than usually falls to the casual Cantab who fails his "special."

The Club System.

But Harvard is no mere highway of courses leading to divisionals washed by a sea of noisy traffic. Although there is no intense concentration of activity to a fixed focus within the university itself, yet there is much characteristic 'varsity life. For instance, there is an intricate club system, which although exclusive, makes life extremely pleasant for a duly elected few. There are dramatic clubs, debating and musical societies; newspapers, and daily and monthly periodicals afford a wide range of interest for literary talents. There are many branches of athletic activity. All these tend to centralize student life and interest. To them the blandishments of Boston society and amusements must take second place.

No university could have a wide range of institutions and lack local colour. The undergraduate himself is a picturesque mortal, clad in the traditional grey trousers and sports coat of his English cousin, yet differing in one respect. The head, which at Cambridge it is a point of undergraduate honour and tradition to expose to the mercy of all weathers, is invariably crowned by a felt hat in the last stages of dilapidation and the ultimate degree of "rakishness." Clubs, the qualifications for which are chiefly social and convivial, are the haunts of these rather romantic-looking individuals. The clubs are invariably quite small, not exceeding a membership of twenty or thirty, and are installed in exceedingly comfortable and attractive houses. No one is eligible for a club until the middle of his second year. Then there is a period of intense activity and excitement. Comparatively unimportant clubs try to enroll the more prominent members among the eligible; while on the other side of the fence, worried nominees wonder whether to accept the first "bid," or wait for a better prospect. It is a trying system, for the emphasis is on *not* belonging to a club, an unfortunate who has not been invited being almost outside the social pale.

Football Training.

Then there is the combined "Hasty Pudding" existing for the production of an annual review, and D. K. E. or "Dickey," which receives its initiates in groups of fifteen amid harrowing ceremonies. The acolytes for this club are seen running between lectures in grey trousers and a dark blue flannel shirt. A week of "running" for the "Dickey" may consist of anything from shooting at sparrows in the square with a bow and arrow to collecting statistics on the percentage of those entering the Capitol Moving Picture Theatre who wear coloured socks! The final stage is a masquerade rag in some conspicuous thoroughfare.

Athletics in all forms are extremely in evidence. In the autumn, football draws vast crowds to Soldiers' Field, the stadium across the Charles River. Looming up above playing fields and trees in its long arched whiteness, the great arena impresses one with a dignity verging on the beautiful. It is becoming an institution now; its bareness is overgrown with ivy and has mellowed in twenty years. Many exciting matches have sent cheers echoing across from tier on tier of gay seething humanity; it is a fit meeting place for university rivalry.

American football is a serious business. Apart from the excitement and rules of the actual games themselves, the stress laid on winning takes away

from the fun of playing the game for its own sake. Always in the back of one's mind lurks the important objective—"Beat Yale." Those who play serious football must literally eat, sleep, think, and live football. It would be unfair to say that all who play football do not enjoy it, yet the training and coaching is such a long tedious process, that it is pleasanter to look back on than actually to experience.

Baseball Etiquette.

A chief sport of the winter months is ice-hockey, played in indoor arenas. This game, with six men a side, is one of the fastest and most exciting. Baseball and rowing follow in the spring. The noise and fast action of baseball are rather a contrast to the more subdued and genteel note of cricket. Having paid a substantial price of admission, the crowd feels entitled to make personal remarks at such players or officials as incur their displeasure, although at an inter-university match more courtesy is displayed. It would be a tremendous shock to those watching a game of cricket, if all the players suddenly ran in from the field, emerged from the pavilion, and started a heated debate with the umpire. Although such a situation would never arise in a university match, it might easily occur in a professional league game, and illustrates the attitude of protest with which baseball jurisdiction is frequently received.

Prominent in all Harvard athletic activities is the "manager," who has no counterpart at Cambridge, although the "honorary secretary" performs many managerial duties. At Harvard the "manager" of a sport is responsible for its complete organization and efficiency. It is he who picks up clothes on the football field, chases the ball when it goes over the fence, holds the extra sticks for the hockey-team, and messes with grease in an attempt to make rowlocks run smoothly for the crew. These are perhaps the simplest of his obligations—they are only mechanical. The others involve the organization of fixtures, advertising, and excursions into the realms of high finance. It is true that the manager has several "assistant managers" under him and a vast corps of candidates for the position, or "heelers," and for the more important managerial positions in football, baseball, hockey, track and rowing, executive ability in handling this organization is what counts. A successful manager of a major sport at Harvard is well on his way to a good job.

Behind the managerial system stands the powerful A.A., or Athletic Association linking up all sports within the university. Thus football with its large surplus pays for practically all other sports except

hockey and baseball, which are self-supporting. Graduate committees direct the policy of the A.A., which is a strong bureaucracy centralized about the graduate treasurer. Sometimes some graduate treasurers are more diplomatic than others; and the recent stupid breaking of athletic relations between Harvard and Princeton, owing to a misunderstanding, should be cleared up with the exercise of sufficient tact.

In spite of the tendency for close organization and centralization in specific undergraduate activities and interests at Harvard, there is in general far less real university life. At Cambridge one's room is one's castle; one studies, eats, entertains, and really lives there; at Harvard one's room is a useful place to drop things between classes and sleep in at night on weekdays. Yet the necessity of balancing one's social and university activities, while reserving sufficient

time for the adequate maintenance of one's scholastic standing, is a very valuable training that is alien from the monastic paternalism of Cambridge. In studies the Harvard undergraduate is constantly kept up to a certain pitch, while his life adjusts itself. At Cambridge undergraduate life is more strictly adjusted, and the assumption is made that the studies will more or less adjust themselves. Different systems such as this have different results. The Harvard man may be more methodical—even more accurate; but the Cambridge man has smoked—he has talked intimately with his preceptors, not of mere shop, but life. His mind has a chance to broaden and mature by intimate association with the older men who are his teachers. One cannot definitely decide which system is the best; each has its advantages and drawbacks. I feel that I am extremely fortunate to have been influenced by both.

Correspondence.

ORIGIN OF THE WORD "TELLAR."

To the Editor of DISCOVERY.

SIR,

Mr. Leonard Jenkins's pretty suggestion as to the origin and meaning of the word *tellar* has greatly interested many of your readers. I have no doubt, if he is a Welshman, as the name would imply, he will probably know of the farming term *talar*—the strip of land left unploughed at the end of the furrow. Indeed, a Welsh scholar will read more than that in the word *talar*. It means to him any bit of land where it has been necessary to raise the ploughshare out of the soil to pass an obstruction, such as a tree or a projecting rock. When a field has been ploughed one way it is ploughed again crosswise to break up the tilth before being further pulverized with the harrow. This cross ploughing when completed appears like spun fabric or woven cloth. The weaver with his piece of cloth borrows a word from the farmer to denote the edge of his production, and calls it *telar*. The tailor, on the other hand, taking that cloth calls it by another term, self-edge or selvage, which means that an edge, although woven differently, is of the selfsame material as the cloth, or as Webster describes it: "edge of a woven fabric . . . finished differently from the surface of the material." But both the tailor and the weaver illustrations are taken from the Latin *taleare*, to cut, and *talea*, a rod or rood, a term of measurement of varying dimensions, but usually taken to equal one-fourth of an acre.

We need not go back very far for a time when the farmer had not partitioned his land at all, except at points where it bordered on someone else's lands. He would certainly have suchlike landmarks on his farm as trees, brooks, and ditches, and certain parts of the farm would be known by those landmarks. When deciding to plough a certain portion he would mark it out from one such landmark to another. Whether that starting-point be a tree or something else it does not matter; it was the point where the plough started and/or finished its *taleare*, its cut of the soil, that has given us the word now spelt *tellar*, and the Welsh *talar* stretches along the whole length of an imaginary

line joining the four corners of the part of the farm ploughed. It is the "selvage" of the field. As I hinted in the beginning of my letter there may occasionally be encountered a projecting rock or a tree to get around, which means that the ploughman has to finish his furrow short of the obstruction, get round or over it, and start again on the other side; and a Welshman would claim this also as *talar*.

This illustration is frequently used in Wales figuratively to denote the "pilgrim" expressing his hope that his "progress" will *talaru mewn gogoniant*, which means that in his progress he may not encounter any obstruction on the way before reaching the headland of Paradise.

I am, etc.,

Docks Library, Cardiff.

W. J. G. EVANS.

The Rev. Leonard Jenkins writes:—"Your correspondent's scholarly notes take the question further than my few quotations, but bear them all out inasmuch as they all include the use of a recurrent which by its regularity serves as a mark—land or otherwise—to facilitate enumeration. Other instances will occur to your readers—for example, 'tale' for the sum of the tellars—the tale of bricks,—*Exodus*, 5, 18; 'the tellers' of the ayes and noes after a division in the Houses of Parliament."

PLANTS AND DISEASES.

To the Editor of DISCOVERY.

SIR,

The article in your August number on insects carrying diseases to plants is interesting, but I think it needs amplifying in regard to the usual remedy—attack the disease—which it suggests.

Instead of looking upon diseases or pests as entirely arbitrary, my observations lead me to consider these conditions indicate that the plants' nutritive economy is below par. And it is to remedying what is in error in the plants that we must look, for dealing with diseases or pests, rather than to merely attacking

these ills and overlooking the condition of the plants favourable to them.

I have found that American blight or woolly aphid on apple trees can be caused to refrain by applying a top dressing of bauxite to the trees; and that nine times out of ten silver blight of fruit trees is caused by sap derangement, produced by exposed trunks—in fact, I think many "ills" in fruit trees can be traced to this cause. Ordinary potato blight I find is amenable to sulphate of potash manuring.

I am, etc.,

Clundon, Auckland, New Zealand.
18th September, 1926.

S. A. BROWNE.

AMAZON VALLEY PROBLEMS.

To the Editor of *Discovery*.

SIR,

I have read the article on "Scientific Problems of the Amazon Valley" with great interest and also with some misgivings.

Although Mr. Domville-Fife is writing from personal knowledge and observation, I find it hard to understand some of his statements about the atmospheric phenomena. He refers, for instance, to the occurrence of electric storms which "frequently seem to be soundless and sometimes apparently cloudless. The whole sky is ablaze with flashes of sheet and fork lightning, and the storm may rage for hours."

In the first place, while a flash of lightning is not impossible in a cloudless sky, a storm of vivid lightning of lengthy duration in a sky free from cloud is wellnigh incredible. One might say that 99.9 per cent of lightning flashes have a cloud at one end and very frequently at both ends. The generally-accepted explanation of the accumulation of large charges of electricity in the atmosphere is bound up with the formation of water drops in a cumulus cloud by ascending currents of air. In fact, the "Meteorological Glossary" (a Meteorological Office publication) says "The first necessity for a thunderstorm is the formation of a cumulus cloud."

Again, lightning is possible without any thunder being heard by the observer who sees the lightning. There may even be, on occasion, a visible but silent discharge. But I find it hard to think that vivid fork lightning can take place without sharp thunder following as a matter of necessity. The thunder is usually attributed to the violent expansion of the air along the track of the discharge, a series of pressure waves being set up which, of course, produce the sensation of sound on striking the ear. C. E. P. Brooks' diagrams in "Distribution of Thunderstorms over the Globe" (another Meteorological Office publication) show that the Upper Amazon Valley is one of the most *thunder* regions of the globe, and that thunder can be heard there on over 100 days per annum.

The probable explanation of what Mr. Domville-Fife wants to tell us may be that vivid lightning can often be seen in the distance but no thunder is heard and the sky is clear over the observer's head. This would be consonant with the known facts that (1) tropical thunderstorms are often very severe and very local; and (2) thunder can seldom be heard above about twelve miles from the flash.

Yours faithfully,

Meteorological Office, Shoeburyness.

C. BRITTON.

Mr. Domville-Fife writes: "There can be little doubt that your correspondent's lucid explanation of the soundless storms observed in the Amazon Valley is correct, although it is difficult to realize that flashes of lightning of sufficient brilliance to

illuminate the forest aisles, and which were not followed by thunder, could have been over twelve miles distant. However, accepting this theory and coupling it with the difficulty occasionally experienced in effecting even short-range wireless communication, together with the entire absence of sunstroke in this region, would seem still to point to some peculiarity in the atmosphere which calls for scientific investigation."

A LETTER FROM CANADA.

To the Editor of *Discovery*.

SIR,

While it is quite clear to all subscribers to *Discovery* that no other journal can be compared to it for the price, because its articles contain unique information from the greatest scientists, men whose opinion is highly valued, it appears to be too select to obtain the circulation it deserves. Why not appeal to readers to furnish data of actual facts encountered in their travels? I presume many subscribers in foreign lands meet with valuable experiences that might benefit our research workers in England, if known to them, and they were put in communication through *Discovery*. If space could be found for notes of actual observations, I believe it would broaden the scope of the journal, and enable subscribers to take a more personal interest in it. Names and addresses might be given so that if, for instance, I felt interested in what someone wrote in Rangoon or Adelaide, I could write direct for further particulars.

Personally I should be glad to furnish any subscriber with information, so far as my knowledge goes, about British Columbia or Alaska.

Yours truly,

Kyuquot, West Coast,
Vancouver Island, B.C.
11th October, 1926.

H. E. NEAVE.

[We are, of course, always pleased to hear from our many friends overseas, and to consider for publication all matters likely to be of general interest.—Ed., *Discovery*.]

The Braking of Aircraft.

ALTHOUGH by reason of its speed the aeroplane is most in need of some form of braking, it is the only vehicle for which a satisfactory system has yet to be discovered. In consequence, deck-landing naval aircraft have to be designed for alighting at low speed, a handicap on their all-round performance compared with land machines; while the cost of the vast spaces necessary for aerodromes is a deterring factor in the commercial development of flying. The problem of devising some method of arresting the forward run of a machine after landing was described at a recent meeting of the Institute of Aeronautical Engineers by Mr. G. H. Dowty, in a paper reported in *The Times*. The type of brake the lecturer had in view was stated to be still at an entirely experimental stage, but consists essentially of a drum caused to rotate by the unwinding of a cable carried inside it. This device should make it possible for an aeroplane landing at 90 m.p.h. to be brought to rest in 100 yards.

Empire Airways : The New Near-Eastern Line.

By A. E. Blake.

An important step in the development of British aerial communication—so much discussed at the Imperial Conference—will be marked by the opening next month of the Indo-Egyptian air line. The following article is compiled from official information.

IT is a curious coincidence that a region which was the cradle of so many ancient civilizations should now be spanned by the fastest means of transport the modern world has evolved. The immemorially old is to become associated with the latest and boldest manifestation of scientific invention.

The less romantic but more significant points of interest in the opening of the Near-Eastern air service in the New Year are the opportunity it will afford for testing the value of air transport under more favourable conditions than obtain in Europe, and the stage the project marks in the social and economic integration of the Empire through aerial communication.

Although confidence is expressed that the European and cross-Channel air services will soon attain such independence of weather conditions as will enable them to justify themselves by the criterion of the balance sheet, it has always been agreed that air transport will show its best results over long distances, which make the saving of time through greater speed a substantial advantage. This condition will be fully satisfied by the Cairo-Karachi air line, whose 2,500 miles represent a short cut between points served regularly only by steamship services with a much slower speed and an indirect route. Furthermore, from a navigational standpoint the new route, unlike the Channel air service with its foggy season and its competition from highly-efficient surface transport, is not a difficult one. There are, however, portions of the route, notably the stretch of desert between Gaza and Baghdad, and along the shore of the Persian Gulf, where a forced landing would be troublesome and, perhaps, even perilous in the absence of ground organization. Although there is no reason to

contemplate such a calamity, Imperial Airways wisely elected to make assurance double sure by employing special aircraft capable of maintaining their loads on only two of their three engines. This precaution, of course, has to be paid for in initial expenditure, which explains why the service is to be, at first, a fortnightly one, instead of weekly as the Air Ministry desired.

Even with this safeguard, however, the chance disaster that defies theory is further anticipated by the elaborate nature of the ground organization and the cautious framing of the operating schedule. It cannot too firmly be emphasized, therefore, that the advantages of speed and time-saving are not to be purchased at the expense of danger.

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In addition to the official support of an annual subsidy of £93,600 for five years, the British Air Ministry is collaborating fully with Imperial Airways in the provision of the ground organization, on which it is expending a further annual sum of £6,400. The Ministry hopes, however, to effect some direct saving from the establishment of the service since, by relieving the Royal Air Force of its present duty of providing rapid communication in the Near East for military purposes—which it discharges by the maintenance of a fortnightly service between Egypt and Iraq—it will be possible to dispense with one aircraft squadron.

For the first three months of operation only the first half of the route, from Cairo to Basra, will be served. Three of the new "Hercules" machines will leave England this month and fly to Cairo. One will fly right through to Delhi, carrying the Secretary of State for Air and Lady Maude Hoare, probably reaching Delhi by 8th or 9th January. A second machine will fly to Basra and remain there until 7th January,



SIR SEFTON BRANCKER AT RUTBA WELLS AERODROME.

The Air Vice-Marshall recently inspected the new route, and is seen outside the tents of the Iraq police. The wells are much frequented by Bedouin tribesmen and an encampment is seen in the background.



THE RAILWAY STATION AT ZIZA.

This is on the Hedjaz Railway running from Amman to Mecca, and stands at the hither extremity of the desert section of the new air route.

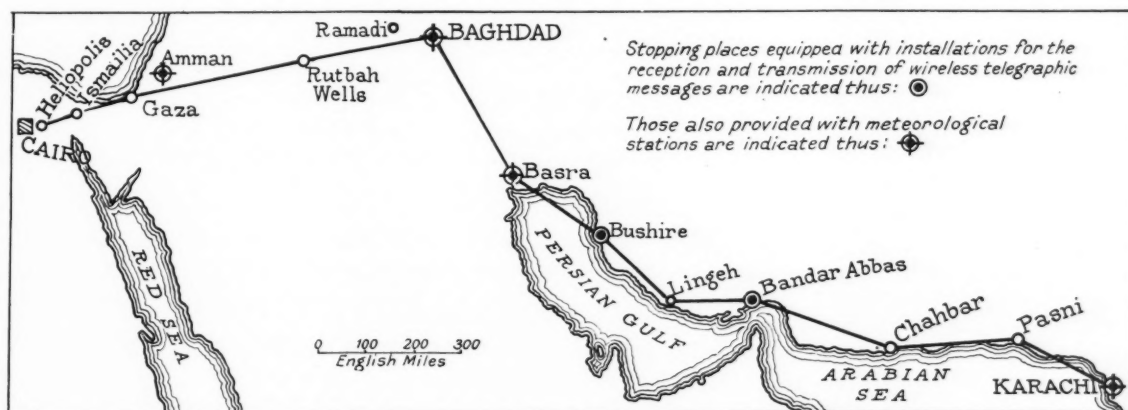
when it will return to Cairo, thus inaugurating the regular service. On the 12th January the third machine will make the first regular flight to Basra. Thereafter, machines will leave Cairo at fortnightly intervals in sequence with the mail steamers from England. The second part of the route, from Basra to Karachi, will only be opened on 6th April, when all five machines are in service.

Along the Cairo-Basra route, a distance of 1,120 miles, the ground organization is, thanks to the five years' work of the R.A.F., already very complete, at least as far as Baghdad. The desert section, a 450-mile stretch which occupies most of the area between Gaza and Baghdad, is difficult only in virtue of its lack of well-defined landmarks and, to provide an artificial guide to air navigation, the R.A.F., in July, 1921, drove a car track and, later, ploughed a furrow across the desert, establishing landing grounds at intervals of twenty miles, and aerodromes—in addition to the terminals—at Ramleh, Amman, and Ramadi.

The ground organization for the whole route of

2,536 miles has been worked out in most elaborate detail. Heliopolis aerodrome, just outside Cairo, has been chosen as the headquarters of the line, its climate being the most suitable for the personnel and for the storage of spares and equipment. Consideration was also given to the fact that urgently needed replacements and supplies could be dispatched from England to Cairo with the least amount of delay. The chief landing stations and aerodromes, at intervals convenient for a single flying stage, are at Gaza, Ziza, Rutbah Wells, Baghdad, Basra, Bushire, Lingeh, Bandar Abbas, Chahbar, and Pasni, while emergency landing grounds and refuelling stations are interposed so that the greatest distance between any two landing grounds is 140 miles. Rutba is, however, the only place on the 450-mile stretch of desert between Gaza and Baghdad where water is procurable, and since it is much frequented by Bedouin tribesmen, a stone fort has now been erected to guard the wells and the refuelling tanks which will be maintained there.

An important factor in the safety of the aircraft is the efficiency of the wireless and meteorological services. Radio communication in the Near and Middle East is, of course, far less dense than in Europe, and consideration of this fact, together with the somewhat frequent and violent atmospheric disturbances common to the region, led to the choice of telegraphic rather than telephonic wireless communication between the stations and the aircraft in flight. Most of the main stations are equipped with complete installations for the reception and transmission of radio messages, but the meteorological organization is, as yet, more complete on the western than the eastern stage. Karachi is at present the only station on the eastern section capable of issuing weather



MAP SHOWING THE ROUTE FOLLOWED BY THE NEW AIR LINE BETWEEN EGYPT AND INDIA.

forecasts, but by the time this part of the line is in constant operation the Iraq stations will no doubt have been fully equipped.

The flying schedule is a triumph of organization, and its complexity may be faintly appreciated when certain limiting factors are considered. In the first place, the speed of the airway and the vast distances traversed make the gain and loss of time when flying with or against the motion of the earth relative to the sun a very considerable difference in the duration of effective operating time, at least until night-flying is introduced. The twilight period in this region, being about half of that enjoyed in England, is a further limit to an elastic flying schedule. Against the variation in flying time due to the apparent movement of the sun has to be balanced the fact that the prevailing winds are northerly or north-westerly and attain an average velocity over the year of from ten to fifteen miles per hour. Thus, in

proceeding eastward, at a constant speed, daylight is lost but ground speed gained and, on the westbound journey, flying time is gained but speed decreased.

In opening up a new air service over such a route, the most stringent requirements for safety have to be satisfied. The task of framing the schedule was therefore further complicated by the necessity for arranging that each machine should be subjected to the same climatic and operating stresses, should give the same performance, and return, in the ordinary course of operation, to the Heliopolis aerodrome for the most rigorous overhaul. This will be provided for by flying the route in relay stages, the machines working back stage by stage until, after eight weeks' service, or about eighty-six flying hours, they return to the workshops. The further precaution of arranging that a machine shall always be in readiness at the terminals and at either end of the Arabian desert route, to provide relief in case of a breakdown, was another complication to be taken into account in devising the schedules.

So different are the conditions of service from those obtaining on the European airways, that a new

type of aircraft was expressly designed by the De Havilland Company. The three Bristol "Jupiter" engines with which each machine will be equipped are of the radial air-cooled type and develop a total of 1,350 h.p. Accidents from failure of water jackets and other unreliable adjuncts of the water-cooled engine, which would be particularly perilous in such a region, are thus obviated. In the rarefied atmosphere in which it will have to function the horse-power developed by the engine will be substantially less for the same revolutions than that of the same engine in the denser atmosphere of Europe. Another modern development in aircraft design

embodied in the machines is the steel construction of the fuselage. The high temperature and high relative humidity of the climate would rapidly decrease the efficiency of one of the old fabric-and-timber aeroplanes.

The new machines will be capable of carrying twelve passengers,

in addition to a pilot and a mechanic-pilot wireless operator, at a speed of from 95 to 100 m.p.h. The total loaded weight of each aeroplane will be 14,800 lb., with a paying load of 2,900 lb. The overall span from wing-tip to wing-tip will be 79 ft. 6 in., and the length 55 ft. 6 in. The fuel tanks will contain 300 gallons, sufficient for the longest stage, while supplies of drinking water will be carried in the machine.

The entire journey will occupy a little over three days, but on the westbound trip only about 33 hours are spent actually in the air, and on the east-bound 29 hours. While only the first half of the route is in operation, a night's stop will be made at Baghdad.

Comparison between the times taken on the journey between places on the route by air, land, and sea are interesting, and illustrate the somewhat peculiar nature of the route. At present, towns on the eastern shores of the Persian Gulf and the Arabian Sea are visited by steamers which, after leaving the Red Sea, call first at Bombay or Karachi and work back along the Gulf. Motor convoys provide land communication



THE "HERCULES" MACHINE TO BE USED ON THE NEW AIR LINE.

This type is fitted with three "Jupiter" engines—though it will fly on two—and has been designed for the special operating conditions of the new route. Its fuselage is of steel, and the machine will carry fourteen people.

for passengers and mails between Egypt and Iraq. It therefore follows that the maximum advantage of the air line in time-saving is exerted at Baghdad and Basra, and decreases proportionately until Karachi is reached.

If four days are assumed to be the time taken on the journey from Cairo to Karachi by air, the corresponding time for the sea voyage is eleven days, while the two days' flight from Cairo to Baghdad takes half the time of the land journey, and compares remarkably with the eighteen days which would be needed for the sea voyage. From Baghdad to Karachi will be two days' journey by air and seven by rail and sea. These margins are sufficiently striking, but by no means represent the final achievement. There is no reason why, after experience of the route has been gained, night-flying should not be introduced, and this would not only greatly reduce the time taken but, by increasing the service without proportionately enlarging the organization and equipment, should effect substantial operating economies. Not only would travel by night be infinitely more pleasant for the passengers, but the absence of fog would

make the proceeding quite free from risk even with existing ground organization.

The Indo-Egyptian air line begins under the most favourable auspices. Able to provide from the beginning a more efficient service than that of the forms of transport at present operating, it yet makes no sacrifice of safety or reliability and retains a margin of power capable of meeting the demand for expansion that is expected to arise. If the traffic is such that a weekly service would be economically justified, the operating company would be able to provide it very soon and with little increase in its equipment.

Time alone will show whether the business community is prepared to give this support, but on the success of the enterprise will depend the rate of growth of imperial air communications. If it fulfils the expectations it has inspired, it will not be long before India is spanned from Karachi or Bombay to Calcutta, via Delhi and Allahabad, and the "All-Red" route is carried by a series of hops from island to island until connexion is made with that remarkable, but too-little known, network of air-lines already established by the enterprise of the Australians.

Chemistry to the Aid of the Diver.

U.S. Bureau of Mines Report.

Investigations in the United States have led to the important discovery of an effective method of preventing the disease to which deep-sea divers are liable. The following report of the work, issued last month by the Bureau of Mines, gives an interesting insight into the problems of diving.

HELIUM, the rare, non-flammable gas so essential in the safe operation of airships, has now found important uses in under-sea exploration. As the result of experimental work in the United States, it has been discovered that the use of the gas in conjunction with oxygen for the "decompression"—or restoration to normal atmospheric conditions—of divers should greatly extend the time and depth of under-water operation, and thus enlarge the whole range of submarine engineering. The employment of helium-oxygen atmospheres was largely responsible for the successful salvaging of the hull of the U.S. Submarine S-51, sunk recently off the coast of Rhode Island; and as a testimonial to the work of the scientists of the Bureau of Mines in developing this new safety factor in diving operations, the ship's bell of the ill-fated vessel is now mounted in the Bureau's great experiment station at Pittsburgh, Pennsylvania. If helium can be made available at comparatively low cost, it is considered that the

possibilities of using such artificial atmospheres for divers during their entire time under pressure are almost unlimited, and that diving hazards will be reduced to a minimum.

The main obstacle to work of any kind under increased air pressure is the danger of the development of "bends"—the common term for symptoms of caisson illness, which often take the form of pains or cramps. This malady arises from too rapid decompression of an individual after having been exposed to atmosphere at high barometric pressure. Since nitrogen gas exists in the blood and body tissues in simple solution—the amount that will be dissolved depending upon the barometric pressure, the temperature, and the co-efficient of solution of the gas—if the decrease in pressure is not carefully controlled and sufficient time is not permitted for the gas to escape quietly into the blood and thence from the lungs, bubbles will form in the tissues and blood vessels. This bubbling action is very similar to that

of a carbonated beverage when the bottle is opened, except, of course, that the gas which causes the liquid to effervesce is carbon dioxide, whereas in caisson sickness the bubbles are mostly nitrogen. The bubbles are most dangerous if formed in the spinal cord and brain, causing paralysis or death, and an additional danger is their tendency to increase in size on further lowering of pressure; there is also the possibility that a number of small bubbles may aggregate to form large ones. Control of decompression to prevent the formation of bubbles is therefore the most difficult problem of caisson and diving work.

Previous Research.

Much work has been done by the U.S. Navy Department and other investigators on arranging suitable tables for the safe decompression of caisson workers and divers, but in spite of precaution the disease often does develop in an individual following exposure to high pressure. As a rule it can be relieved and controlled by recompressing—that is, by putting the victim back under pressure, which decreases the size of the nitrogen bubbles causing the trouble, so that the symptoms disappear as soon as the adequate pressure is reached. When a subject with “bends” is recompressed immediately, the treatment is usually successful, but if it is delayed, sufficient damage may be done to the tissues to produce more or less lasting symptoms, or the victim may die through bubbles in the heart or brain.

A diver may descend rapidly with no ill-effects from pressure so long as he keeps his ears cleared—that is, the same pressure inside the eardrum as outside—otherwise he is liable to severe pain, if not rupture or breaking of the membrane. A good diver can descend to 190 feet in two to three minutes without difficulty—in fact, as rapidly as his tenders can feed out his hose, life-line, and telephone cable, which are usually bound together to form a single line. On reaching the bottom or the working place, the men cease feeding him line except to take it in or play it out to meet the necessity of his movements.

When ready to start back to the surface the tenders haul in the line and lift the diver from the bottom. Experienced divers can make themselves light by increasing the pressure in their diving-dress, thereby making themselves more buoyant. The ascent, however, is not usually a continuous one. The decompression schedules are based on stages of decompression, or rests at various intervals of depth, the diver being hauled up a certain distance and then stopped for a period to allow the excess gas to escape from his body fluids and tissues. The number of

these stops increases with the depth and period he has been exposed to the pressure at the bottom. In some cases a steel platform is lowered over the side of the diving barge to a point above where there is danger of entanglement in wreckage or obstructions on the bottom, and which is free from the hose and life-lines of other divers who may be down at the same time. When the diver who is undergoing decompression reaches the platform on his way up, he crawls on to this and is hauled the remainder of the way by a winch or derrick, but stops are made at various intervals as before.

When the diver is finally lifted from the water he is undressed rapidly, sometimes given a stimulant if cold, and always examined for the first signs of bends. If these are observed he is immediately placed inside a specially designed steel chamber and recompressed to relieve the symptoms. If no steel chamber, sometimes called by divers the “iron doctor,” is available, the diver may be lowered again into the water to obtain relief.

The precautions which must be taken to arrest the occurrence of caisson illness, and the time required to decompress or bring a diver back to the surface after he has performed his work, have always been a major factor in the depth and range of diving work. The deeper a man dives, and the longer he stays on the bottom at work, the more excess nitrogen he will absorb; consequently, it will take much longer to decompress safely and bring him back to the surface. This decompression time increases rapidly at depths below 100 feet, and at 200 to 250 feet the time becomes too long for practical work, even though the working period is reduced to ten or twenty minutes. For example, it would require several hours to decompress safely and bring back to the surface a diver who has worked fifteen to twenty minutes at a depth of 250 feet.

Present Disadvantages.

This long period of decompression is fatiguing to the divers and also may be dangerous to undertake. Storms may arise which, because of the rise and fall of the ship, would likewise jerk the diver up and down, as he virtually hangs on a rope on the side of the vessel. This often causes nausea, or injury, especially to his ears, through the change in pressure at the up-and-down positions through which he rises and falls. The water may be very cold and he may suffer from numbness and poor circulation; something may go wrong with the diving equipment; or he may become injured. All of these factors make long decompression periods hazardous and have indirectly limited the range and depth of undersea work.

Nearly all investigators agree that the nitrogen of the air breathed by the diver is the main cause for the bubbles. Normal atmospheric air contains approximately 79 per cent of nitrogen and 21 per cent oxygen. There is a small amount of carbon dioxide (0.03 per cent) and some rare gases, but these are apparently of no marked significance.

New Method Discovered.

Recently the Bureau of Mines became interested in pressure and caisson work, and as a result started investigations at its Pittsburgh experiment station. This work was initiated by Dr. R. R. Sayers, chief surgeon of the Bureau, Mr. W. P. Yant, associate chemist, and Dr. J. Hildebrand, professor of chemistry in the University of California. An attempt was made to develop a synthetic atmosphere which would be more suitable for divers than ordinary air. After a large number of experiments had been made on animals, it was found that by replacing the nitrogen of the air with helium, and also reducing the oxygen content below that of normal air, an atmosphere could be made which would permit decompression in one-third to one-fourth the time required for air, and that also the deleterious effects from oxygen poisoning could be prevented.

The advantage of helium is that it is only about half as soluble as nitrogen, and thereby greatly reduces the amount of excess gas that a man will accumulate while under pressure and that will have to be given off in decompression. Also, because the helium molecule is smaller than nitrogen, it will diffuse more rapidly, and the escape of the excess gas will be facilitated. The quantity of oxygen is controlled within the amounts which will not cause deleterious effects, yet be sufficient for performing work. For very high pressure the amount of oxygen in the synthetic air may be insufficient to support life at ordinary atmospheric pressure or low pressures, and in these circumstances it must be enriched, but at the higher pressures it is adequate.

Animals were subjected to pressures of 500 pounds and decompressed with no apparent ill-effects. A 500-pound pressure is equivalent to a head or depth of about 1,200 feet of water, or about four times that of the record dive in Pearl Harbour made by U.S. naval divers a number of years ago. Divers often work at depths greater than 150 feet, but very seldom at 200 feet. The work carried out on animals does not signify that men will be able to go to those very high pressures, because animals are more easily decompressed than men, but it does signify that the depth may be markedly increased and the period of

decompression decreased. Animals similarly exposed to ordinary air could not stand the pressure and required a much longer period of decompression for even lower pressures.

With this information, the investigators consulted with the Navy Department, and a trial test on men was arranged under the supervision of Chief-Gunner Tibbals, Commander of the U.S. Salvage Ship "Falcon," who was the first man to use the synthetic atmosphere under pressure. After a successful experiment, two more of the crew volunteered for tests which were also successful. As a result, a co-operative investigation was planned between the Navy Department and the Bureau of Mines for conducting a more thorough investigation of the advantages to be gained by the use of synthetic atmospheres, likewise to work out favourable rates of decompression and to make a study of caisson illness with a view of devising ways and means of prevention. Commander Tibbals and seven experienced divers were detailed to work in co-operation with the investigators at Pittsburgh, who were also joined by Dr. Charles Reinke, of the U.S. Public Health Service, in the medical phase of the work.

A rather extensive programme has been started. The experiments are conducted, with men as subjects, in a large pressure chamber or room, the most modern of its kind, which has been built at the U.S. Navy Yard at Norfolk, Va. It has electric lights, telephone, windows, fan, and adequate control apparatus, all designed to stand a test pressure of 1,000 pounds or 600 pounds working pressure, the walls and doors being of steel approximately one and a half inches thick. Another tank into which divers may be placed under pressure to simulate diving conditions will be used in order to conduct work under practical conditions.

Successful Practical Tests.

During the course of the investigation the work has been twice temporarily discontinued to allow the personnel to take part in diving and salvaging operations. The first of these was for inspection of the S.S. "Lakeland," a vessel which sank in about 200 feet of water a few years ago in Lake Michigan, just outside the Sturgeon Bay Canal. This necessitated the inspection of the inside of the vessel, a feat not previously attempted on such an extensive scale, but the work was successfully carried out without injury to any of the five divers. The investigators at Pittsburgh had only just returned from the inspection of the "Lakeland" when the U.S. Submarine S-51—as mentioned previously—was rammed and sunk

by the coastal steamer "City of Rome." The entire diving personnel therefore joined the salvage crew of the U.S. Salvage Ship "Falcon," to aid in the recovery of the lost vessel.

In the salvaging of the S-51, the helium atmosphere played an important role. At all times in the decompression chamber there was a full tank of a synthetic atmosphere of helium and oxygen, attached to a breathing apparatus. In case a diver developed bends, or in case recompression after the development of bends did not correct the condition with satisfactory promptness, the subject donned the breathing apparatus and inhaled the synthetic helium atmosphere while under the pressure. His nitrogen became replaced in this way by the helium, and this gas, being so much more easily eliminated, accelerated his recovery and often removed the symptoms in surprisingly short periods, as compared with the normal atmospheric air.

Future Possibilities.

Were it not for the high cost of helium, the possibilities of using a synthetic atmosphere of helium and oxygen during the entire period divers are under pressure would be almost unlimited. Instead of an hour on the bottom at 135 feet depth, nearly two hours could be spent, without any increase in the period of decompression. This would permit of much faster work without the constant interruptions incident to the changing of shifts or, on the other hand, work might be carried on by a diver for an hour at a depth of more than 200 feet. This would make possible the rescuing of many wrecks, which are not now considered practicable for salvage on account of the enormous period necessary to decompress workers who might descend to the requisite depth. Under present conditions, however, diving hazards have been reduced to a minimum, for granting the presence of a trained observer in charge of the personnel, the symptoms of caisson illness can be recognized as soon as they develop. Prompt recompression, especially if the helium apparatus is used, will in every case control the trouble, after which it is merely a question of decompression at an adequately slow rate of speed.

Landsmen may not be generally aware of the intense rivalry for possession of the signal bell of a sunken craft which is customarily indulged in by deep-sea divers. In the case of the bell of the S-51, the divers engaged in a most unusual game of submarine hide-and-seek. "It became a matter of personal pride with some of us to keep the bell out of the way of the remainder of the men," said one of the divers. "To-day the bell would be in a given spot; to-morrow some enterprising diver, happening upon its hiding-

place, might stow it away in an entirely new place, from which it might be salvaged by a third party. As the original 'thief' of the bell, I was often hard-pressed to keep ahead of the others in discovering new hiding-places. The day came when I deemed it wise to attempt to bring the much-sought-after bell to the surface. I had hidden it for two or three days prior to this in the engine-room, a place frequented by few, but these were my most formidable competitors. The 'trail' was becoming decidedly hot; I knew that soon someone would be sure to stumble upon the treasure and ruin my chances of being the lucky man, and I thought it advisable to bring it to the surface before it should be restolen from me.

"In deep-sea diving two divers usually work together on each given place of work. It so happened that one morning I was working with a veteran undersea man. We were engaged upon a risky and ticklish bit of work in the engine-room and, having completed the job in good time, were about to give the signal to those above that we were ready to ascend, when I thought that it was probably the most propitious time for salvaging the treasure. Accordingly, I brought out the bell from its hiding-place and passed it up through the engine-room hatch to my mystified colleague, who had not in the least grasped the significance of my antics. With the bell once safely on the deck of the submarine, I explained the situation to him by means of signs, and he willingly fastened the heavy bell to my diving belt. This done, we signalled to be taken up with our long-desired loot."

Wireless Trade Progress.

It was announced last month that the old-established business of Alfred Graham & Co. is now divided up into two limited companies: Alfred Graham & Co. Ltd. and Graham Amplion Limited. The latter undertake the manufacture and sale of "Amplion" wireless loud speakers, and other radio and electric products, while the other new company will continue to operate the naval telephone side of the business. The two companies will be in complete liaison. An interesting feature is the return to this business, after many years, of its founder, Mr. Alfred Graham, who becomes chairman of both companies.

A large international organization has been created under the control of Graham Amplion Limited, which at present consists of concerns in Canada, the United States, Australia, Belgium, and France.

The chief cause for this radical change in the constitution of the business was the regrettable death of its late head, Mr. E. A. Graham, though increased business progress has also made the division necessary.

The Month's Wireless Developments.

THE NEW SHORT-WAVE SYSTEM.

By F. H. Masters.

Editor of "The Electrician."

WITH the establishment of the short-wave beam service between this country and Canada and South Africa—and its extension to other Dominions in the near future—something like a revolution has taken place in the outlook of radio engineers. In the first place, as Mr. Marconi pointed out in the James Forrest lecture which he recently delivered before the Institution of Civil Engineers, five years ago they thought they knew a good deal more about the subject than they realize they know now. In the second place their ideas have been considerably modified. This is the result of the successful work done by Mr. Marconi himself, and by his able assistants Mr. Franklin and Mr. Vyvyan, which has clearly indicated that communication by short waves has greater possibilities from many points of view than by long.

Five years ago certain laws of radio transmission were almost universally accepted. These showed which wave lengths were best adapted for the various distances, and indicated what amount of power would be necessary to communicate over any given distance. The results were startling, for it was evident that, if true, they would necessitate the erection of very large and costly aerial systems and the employment of amounts of power which would render the whole scheme commercially unattractive. For instance, long-wave stations, such as Rugby and Carnarvon in this country, which use wave-lengths between 8,000 and 30,000 metres, cost some £500,000 to build, and necessitate the expenditure of considerable amounts of power to operate. Moreover, their transmitting speed is not great.

It therefore occurred to Mr. Marconi that it would be advantageous to consider the possibilities of short-wave transmission. Power could certainly be saved in that way, and tests showed, as readers of *Discovery* are now aware, that there are other advantages, such as freedom from interference and increased range under certain conditions, even in daylight. A further great advantage is that there are 3,700 wave bands practicable for short waves between 5 and 100 metres, and only 90 for the long waves between 5,000 and 30,000 metres. This means that more stations using wave-lengths quite close together can be employed without interference with each other. Again, it is possible for the signals from these stations to be "directed" so that a large proportion of their power is confined within a very narrow angle. This considerably cuts down the risk of interference. Finally, as the results of the tests made between this country and Canada under adverse conditions show, the speed is much higher than with long waves, being on the average 100 as against 20 words per minute.

The commercial telegraphic service between Great Britain and Canada started five weeks ago is provided from a sending station at Bodmin, and a receiving station at Bridgwater. The South African service will be dealt with from the same two places. The wave-length is 26 metres, though arrangements have been made for using a slightly different wave-length, should interference occur. Mr. Marconi has stated that the results so far obtained on the new service have convinced him that a good directional system of this kind is the system of the future for point-to-point radio communication over long distances. And he also confidently expects that it can be utilized for tele-

phonic and broadcasting purposes, and also for such new applications as television. Whether this confidence is justified time will prove. In the meantime there is no doubt that short waves provide a method whereby communication between all parts of the Empire can be obtained in an economic and efficient way.

CHRISTMAS RADIO FARE.

By Edward Liveing, M.A.

Manchester Station Director, B.B.C.

NEARLY every activity in human life is reflected in broadcasting to-day, whether it be founded on ancient tradition or spring from modern scientific knowledge. It is not a strange thing that the old traditions and institutions that still retain their influence over our lives should be mirrored in this new medium of expression. British broadcasting has always celebrated Christmas with the respect due to it, and this year, as in past years, listeners will be able to enjoy the plentiful fare of seasonable music and entertainment and talk that will add their colour to the happy interests of home at this time. Among the leading features that may be anticipated in the national programmes during Christmas week will be the performance of the opera "Hansel and Gretel" on Tuesday, 21st December; a village Nativity Play which will actually be relayed from Marazion in Cornwall, on the evening of Wednesday, 22nd December; and carols relayed from Whitechapel on Christmas Eve. In the afternoon of Christmas Day a service from Canterbury Cathedral will be relayed, followed by a reading by the well-known actor, George Grossmith. On Sunday, 19th December, Vaughan Williams will conduct a programme of his own compositions from the London Studio, and it is anticipated that on the following Sunday a service will be relayed from Norwich Cathedral in the afternoon. On the evening of Monday, 27th December, the pantomime "Cinderella" will be relayed from the London Studio. There is not space to outline in further detail all the Christmas programmes, but more than one station is relaying a special programme from a hospital. An interesting talk on "The Origin of Christmas" will be given from the Manchester Station in December by this year's President of the Classical Association—who is also a Trustee of *Discovery*—Professor R. S. Conway.

Broadcasting and Adult Education.

At the end of October a joint committee of inquiry by the B.B.C. and the British Institute of Adult Education began to inquire into the possibilities of broadcasting in relation to adult education. The B.B.C. has always been interested in this side of its work and realizes that, when it can offer the public a greater number of alternative programmes, it will be able to concentrate more thoroughly on the provision of facilities to those adults who desire to benefit from what may truly be called a "Broadcast University." The chairman of the committee is Sir W. H. Hadow, while the B.B.C. is represented by Mr. J. C. W. Reith, the managing director, Mr. J. C. Stobart, the director of education, and other representatives. The committee intends to invite various important educational organizations to give evidence, and it is anticipated that much valuable data will accrue. The inquiry is likely to be very comprehensive.

Book Reviews.

British Spiders: Their Haunts and Habits. By THEODORE H. SAVORY. (Oxford: At the Clarendon Press. 6s.).

"If you want to live and thrive,
Let the spider run alive."

Mr. T. H. Savory, of St. John's College, Cambridge, has in the current number of *The Annals and Magazine of Natural History* published a paper in which he offers a new classification of spiders.

It is undoubtedly true, as he says, that changes in habit have played an important part in the evolution of the Araneae, habits which now clearly divide the groups of families from each other. "For example, there are the hunting spiders, three distinct races of them, originating as three separate branches of the evolutionary tree; there are at least five distinct groups of web-spinners, spinning more or less different types of web, an evolution of web-forms which it is to some extent possible to follow."

"All these represent different lines of development of the spider race and, as our classifications stand at present, exist as nameless and all but unrecognized stages intermediate between the suborder and the family. It is, of course, possible to leave them unnamed, and many will wish to do so, partly from innate conservatism, partly from an apparent horror of admitting any new division between family and suborder. But if we do so, our scheme of classification is at once becoming stereotyped, ceasing to be natural, ceasing to express racial history, and losing its most valuable function of summarizing existing knowledge. It becomes a dead index, in which alphabetical order would be as good as, or better than, any other."

This contribution is likely to form an important stage in our history of the classification of a very difficult and numerous group. It deals with all spiders, whereas his little book on "British Spiders: Their Haunts and Habits" is confined to those which we can ourselves investigate. The book is divided into two parts, one on the structure and habits of spiders, their instincts and senses, the other a very detailed account of special species. The author's account of the way in which young spiders are dispersed by letting a stream of silk several feet in length into the air to be caught up by any passing breeze, a phenomenon in fact called gossamer, is followed by an admirable passage on the use of silk in spiders. This gives an example of the pleasant way in which our author writes:—

In this way the little spider makes use for the first time of silk, a material that governs its whole life. It has been born into a silk nursery, and on a silk monoplane it flies away; with a silk web it catches its food, binding up with silk threads and ribbons its struggling prey or its bitter enemies. It drops from peril on a silk rope; of a silk sheet it makes its cocoon; its eggs are wrapped round with silk cushions. In a silk chamber it sleeps through the cold of winter, and even in death it is sometimes wrapped in a silk shroud. It is a remarkable biological fact that although the spider makes so many uses of this invaluable material, few other creatures can produce it, and none uses it to anything like the same extent.

Unfortunately this silk has never been found of any practical value to mankind. It has been calculated that it requires 60,000 spiders to produce a pound of silk, and the impossibility of supplying such a multitude with food renders this an uneconomic "proposition," as they say in America.

Spiders as a rule feed on living insects and are especially adapted for sucking fluids. In captivity, however, there seems to be nothing that the spider will not eat.

All kinds of flies and daddy-long-legs, bees, wasps, ants, earwigs, beetles, moths, butterflies, woodlice, harvestmen, and other spiders are all treated alike; caterpillars are consumed entirely; chrysalides, worms, and even small fish are bitten and sucked for what they are worth. Raw meat and the ends of young feathers have also been used by some—there is no sort of discrimination.

But in their natural life they are little apt to come across the last-named sources of food. They eagerly eat their own species, and the fact that the female will fall upon a smaller male after he has fertilized her is well known to all naturalists.

Amongst the descriptions of the different species the water spider stands out. Of all the thousands of species in our northern hemisphere this is the only one which has assumed the habit of living under water. It lives, in fact, in the centre of a glistening bubble of air. When this bubble is exhausted the little creature swims to the surface and raises her abdomen through the surface film. As she dives again this surface film is drawn out and sinks with her, thus cutting off a bubble of air of an unrivalled silvery brightness. Her aquatic home is a diving bell, in the cavity of which she brings bubble after bubble of air. They are long-lived creatures, surviving for several years, and each year two diving bells are built. During the autumn she goes into winter quarters deep in the water, surrounded by a closely-woven mantle. Here the colder months are passed in a stage of inactivity. Curiously enough, the male of this species is the only common spider which is larger than the female. He also makes a diving bell close to the dome of the female he proposes to court. He then joins them by a silken passage, and by tearing away the intervening walls unites the two domes and the two air-bubbles. One would imagine that such a life-history would be associated with curious structural features but, as a matter of fact, no such adaptations are shown. *Agyroneta* is indeed a very ordinary-looking spider, and apart from its glistening surroundings a very insignificant one.

This little book closes with an appendix on the collection and preservation of these interesting but little-known creatures, supplemented by a good bibliography, a glossary, and a carefully prepared index.

A. E. S.

The Week: An Essay on the Origin and Development of the Seven-day Cycle. By F. H. COLSON. (Cambridge University Press. 5s.).

Mr. Colson has hitherto been known as a classical scholar, an authority on ancient rhetoric. But it is the honourable tradition of philology to preserve a close connexion with science, and so, appropriately enough, he appears as the author of a work dealing with a theme historical and scientific.

Why do we count in weeks, and if we must do so, why do we name the days after the planets, or what were once supposed to be the planets? Most people probably have a vague idea that it all has something to do with the Jews; but the Jews have, strictly speaking, no week, but only a succession of Sabbaths, each seven days from the one before it. Whence comes, not simply this astrological naming of the days, but the wide acceptance of such naming? It has nothing to do with Christianity, any more than with Judaism, for astrology was many times denounced as impious by the Church, before it was proved nonsensical by science.

Mr. Colson suggests that the Sabbath was well-known as a Jewish institution in the Gentile world, and especially in Egypt with its large Jewish colony, a little before our era. It would be known that it was the holy day of Yahweh. Now Yahweh, for reasons which Mr. Colson does not enter into, and

which it would take too long to give here, was readily identified with Kronos. What more natural than for an astrologer to assume that the star of Kronos (the planet Saturn) was the regent of the first hour of the Sabbath? Taking now the planets in a very common order, the second hour belongs to the Moon, the third to Mercury, the next hours to Venus, the Sun, Mars, and Jupiter until, when we reach the first hour of the next day, the Sun is regent, the next day the Moon, and so on, in the familiar order of our days.

Sunday, Saturday, and the rest being thus established, it was very natural that, by the times in which Christianity spread, the average man should know of the planetary week, in order to regulate his actions according to the stars under whose influence he supposed each day to be. Also it was very natural that non-Jewish converts to Christianity should retain an affection for the day governed by the greatest of the luminaries, the Sun; hence, at least partly, the establishment of Sunday as the Christian festival corresponding to the Sabbath. The non-Christian parts of Europe had heard of the planetary days before they heard of the new religion, wherefore the Christian names, "first day," "second day," and so on, did not gain universal currency, especially in the West.

The book is thus suggestive and interesting; it is, however, a pity that Mr. Colson did not stay to revise some parts of it more thoroughly, fill one or two gaps in the argument, clear away a number of mistakes in details, and generally digest his material rather better. The reviewer hopes that it will reach a second edition, in which no doubt the opportunity of making these improvements will be taken.

H. J. R.

- (1) *Stainless Iron and Steel*. By J. H. G. MONYPENNY. (Chapman & Hall. 21s.).
- (2) *Tungsten: A Treatise on its Metallurgy, Properties, and Applications*. By C. J. SMITHELLS. (Chapman & Hall. 21s.).

A striking feature of the metallurgical progress of the twentieth century has been the introduction of many new metals and alloys into the field of industry. The traditional bronze, brass, iron, and carbon steels have been supplemented by a host of alloy steels and non-ferrous alloys, some of which owe their special properties to the presence of elements which, only a few years ago, ranked as curiosities, of interest to the chemist but without practical importance. When a new metal has been found to have valuable properties, and the difficulties of its extraction and purification have been overcome, it has often been found to be less rare than had been supposed, the minerals in which it occurs having been overlooked by prospectors until their attention was specially directed to them. The two books before us deal with two such developments in metallurgy, both of which have influenced profoundly the advance of industry.

(1) Mr. Monypenny describes the new class of stainless steels, characterized by a high resistance to corrosion by the atmosphere and many chemical substances. They owe their properties to the presence of chromium in large proportion, with or without the addition of nickel. The first alloy of the series was Brearley's stainless cutlery steel, containing about 14 per cent of chromium and sufficient carbon to give the required hardness when properly quenched and tempered. Higher carbon gave a steel suitable for use as cylinder valves, resisting high temperatures without oxidation. By reducing the carbon to the lowest practicable limit, ductile alloys were obtained, which retained their non-

corroding properties in the soft or worked conditions. By adding nickel, still more resistant alloys were produced, the early experiments having been made in Germany, whilst the later developments have mainly come from Sheffield. The properties of these alloys are well and thoroughly described by the author, who has successfully avoided the tendency to advertisement which mars some publications on this subject. His book is admirably illustrated, and will be found a trustworthy guide to the use and treatment of the whole range of so-called stainless steels, although little is said of their manufacture, which is known to present some difficulties. It should be noticed that as the proportions of nickel and chromium increase, the alloy steels pass insensibly into the nichromes, in which the iron is present in reduced amount or entirely absent, the boundary between ferrous and non-ferrous alloys thus becoming indefinite.

(2) Tungsten has the highest melting-point of all the metals, and therefore has special advantages for applications which require exposure of a metal to very high temperatures. The properties of tungsten have made possible the great improvement in efficiency of the incandescent electric lamp, by increasing the temperature of the filament. In the older textbooks tungsten was described as a very hard brittle metal, owing to the fact that it always contained carbon, and extraordinary difficulties had to be overcome before it could be obtained in the form of a ductile wire, capable of being drawn to an exceedingly fine filament of high tensile strength and flexibility. The story of its preparation is excellently told by Mr. SmitHELLS, who has had the advantage of working with the metal in all its forms for a long time. It will seem strange to the reader accustomed only to the commoner metals to read of the careful purification of the oxide in silica vessels, the reduction of that oxide by hydrogen in silica tubes, and the swaging of the rods of sintered metal in an atmosphere of hydrogen at a very high temperature, operations which seem appropriate to the research laboratory rather than to the factory. The process is now quite successful, and full details of it are given in this book. The physical properties have been studied with great minuteness, on account of the use of the metal in wireless valves as well as in lamps, and its properties at high temperatures are now known with greater accuracy than those of the more familiar metals. Its study by means of X-rays has proved to be a fascinating one, and the results are here collected and analysed. The electrical industry makes little use of secrecy, and the facts of such a special branch of manufacture as this are set out with great frankness, to the advantage of both industry and science. The work will be found of interest to the student of physics or of chemistry as well as to the metallurgist or the electrical engineer.

C. H. DESCH.

- Winter Blossoms from the Outdoor Garden*. By A. W. DARNELL. (L. Reeve & Co. 21s.).

Now that the thing has been done, and done remarkably well, it seems odd that no one should have thought of the idea before; we seemed to have books on every possible kind of gardening, yet it never occurred to anyone to write a book for the education of those many gardeners who chant monotonously "of course there is nothing to be seen in the garden just now" during the winter months. Perhaps it is as well that no horticultural journalist was tempted to "do" the subject with scissors and paste, but that we should have had to wait for Mr. Darnell to complete a life's work in collecting some three or four hundred plants which will flower in the open ground during December,

January, and February, studying their needs, minutely describing their beauty and measuring their hardness through the varying English winters.

Gardeners, in spite of their alleged passion for novelties, are a strangely conservative race or they would long ago have appreciated the merits of *Iris stylosa*, *Chimonanthus fragrans*, *Hamamelis mollis*, and *Lonicera fragrantissima*, which are frost- and storm-proof, give us sweet-scented flowers in the depth of winter, can be grown in any suburban garden and yet are seldom seen anywhere.

The author arranges his plants in alphabetical order with a full, non-technical description of each and directions for cultivation. Some of the plants are tender and suitable only for the more favoured districts, but we are coming to learn that these "favoured districts" are not limited to the Cornish peninsula, but extend in a broad belt round our south and west coasts even to the north of Scotland, and there are probably many more places than is commonly supposed where *Lapageria rosea* would drape a north wall with its tropical pink trumpets and "Mimosa" brave out the winter.

The illustrations are lithographs (many of them coloured) executed in the old tradition of Curtis, Paxton, etc., by Mr. Darnell himself, and the uncompromising designs bring out the character of the plant with a vigour that is often wanting in pretty water colours or detailed photographs. In only one block, that of *Chimonanthus fragrans*, has the colour gone astray. It is not too much to say that this book should find a place among the classics of horticultural literature, for it is worthy of the companionship of the assured immortals in the gardener's library.

There is room for improvement, which a second edition ought soon to make possible. The whole book might be compressed and some repetition avoided by grouping the species more closely under their respective genera. The author might reconsider the classification of Darwin's Barberry as a form of *Berberis buxifolia* and the statement that *Erica carnea* is an inveterate lime-hater. Room might be found among the winter-flowerers for *Osmanthus Delavayi*, the Rosemary, and the little Chinese shrub, *Sarcococca humilis*. There are several misprints, "Brodiae," "Wedini," "Helleborus cupresus," "Parochetus," "Tulipa saxatilis," and "the Corinthian Alps," which have escaped the proof-reader.

F. A. H.

The Importance of Diet in Relation to Health. Being the People's League of Health lectures. (Routledge. 3s. 6d.).

The growing tendencies observable during the last quarter of a century in the preparation of food have been in the direction of its production in a condition differing from that in which Nature provides it. It may therefore have lost some of those constituents which, although minute in proportion, have been shown by the recent advance of knowledge to be of some considerable importance. The connexion of milled or prepared rice with a deficiency disease like beri-beri is well-known.

At the same time the food may have been bleached by means of chemical treatment, or mixed with a dye to give it a more attractive appearance. Further, it is frequently mixed with preservatives to prevent decay. It should not be assumed that the treatment has had no effect upon the dietetic value of the food. While there may not be direct evidence of harmful results arising from all these processes, there is in the case of some, notably certain chemical preservatives, sufficient to show that foods so treated cannot be taken without loss of health.

The difficulty of diagnosis of harm is to be found in the great store of health possessed by many individuals being drawn upon without perceptible ill effects. The ill is being done, and it is not recognized until too late.

This little book on "Importance of Diet in Relation to Health" contains six addresses on various aspects of food and feeding. It includes an extremely interesting lecture by Sir D'Arcy Power on the "Food of Mankind," the dietary, the cooking, and the ritual of dining being treated from the historical point of view. The subject is dealt with in an attractive manner, and compels attention from the comparison the present generation is able to make with the habits of our fathers regarding meals, mealtimes, and meal utensils. But the practical importance of the book is to be found in the other five lectures which deal succinctly and pointedly with important aspects of food and feeding.

Professor Leonard Hill, of the National Institute for Medical Research, gives timely counsel on the "General Principles of Diet"; Professor Halliburton discourses on the "Vitamins"; Dr. Scurfield deals with the subject of "Infant Feeding"; Dr. Rowlands points out in his lecture the very great importance of securing that the stock from which so much of the food of the people in the form of milk products, eggs, and flesh meat should be free from disease; and Professor Dixon, of Cambridge, who was a member of the Government Committee which recently inquired into the use of preservatives and colouring matters in food, deals in an able manner with "Food Adulteration, and Preservatives Dangerous to the Health of the People."

It would be easy to make long extracts of value from these papers; a wiser course is to recommend those who have regard for health to study this book and to make some effort towards bringing their own diet and the diet of those for whose upbringing they are responsible into line with the principles so cogently expressed in these papers.

G. STUBBS.

The Memory Factor in Biology. By C. J. PATTEN, M.A., M.D., Sc.D. (Baillière, Tindall & Cox. 5s.).

The importance of a book is not to be judged by its size; Professor Patten's "Sketch of the Unity of Life" is decidedly an important work, yet it comprises but one hundred and seventy-five pages, every one of which contains something worth reading. It sets out to show that memory is the main-spring of evolution, and that evolution alone teaches anything about memory processes, and it demonstrates these contentions convincingly. It contrasts Dualism, sprung originally from the imperfect conceptions of primitive man and belonging to the realm of superstition, with the Monism which is supplanting it. Professor Patten's contentions are essentially rationalistic, and he points out that the rational view is the outcome mainly of the vast spread of biological knowledge and "is becoming a human instrument of gigantic potentiality, which is denouncing and rapidly driving out crude superstitious concepts." His book is, therefore, a potent antidote to those dualistic reactionists who are striving, by preventing the biological education which is so much needed in certain states, to pander to the opinion of the middle-west of America; for the memory hypothesis of evolution which he so ably argues "gives life and vigour to the conception of natural selection." The memory factor is emphasized in ontogeny and phylogeny; it is, further, as apparent in the manifestations of somatic as in those of germ cells, and the author is "convinced that the doctrine of the non-inheritance of acquired characters is steadily losing ground."

Hence Weissmannism, which he, like Sir Francis Darwin, finds difficult to grasp, "is on the road to far-reaching modification if not to refutation." The evidence which he adduces in support of his theme is strong and well put, and his optimism is contagious, for the train of thought which runs throughout the book has a distinct bearing on problems concerned with man's future affairs. One of the most interesting of his arresting chapters is that dealing with memory and education, in which the enormous importance of a biological training, including a working knowledge of embryology, is pleaded with skill. "Every rational psychologist must be well acquainted with the anatomy and physiology of the brain. He who is out of sympathy with biological methods and concepts, if he attempt to fathom psychological problems will, I greatly fear, find himself wrestling with purely speculative introspective measures. It would be well if those who pressed for social reform were drawn from the ranks of biologists, or at least that a proper representation of persons, in sympathy with biological truths, grappled with the issue. . . . The outlook of the biologist in regard to human affairs touches not merely the decades of a lifetime or two, but of hundreds or thousands of years." Hence, apart from Professor Patten's discussion of the more technical aspects of his theme, he has many sound opinions to offer to his readers concerning education, social reform, Bible teaching, and other problems of modern life. His book calls for serious attention and careful consideration.

M. Y.

Evolution and Religion in Education. By HENRY FAIRFIELD OSBORN, Research Professor of Zoology, Columbia University. (Charles Scribner's Sons. 7s. 6d.).

One of the features of this book is its unfailing good humour. It speaks highly for both Professor Osborn and Mr. Bryan that they could differ so widely and so publicly without lessening their respect for each other.

As Professor Osborn points out, his book consists of addresses and articles written in haste to meet the ever-varying emergencies that were constantly arising over the Dayton trial. Many were delivered on the spur of the moment, sometimes extemporaneously to College and University students and teachers. In spite of that the book is uncommonly well written, and covers pretty well the whole field. One of the sections of Chapter I deals with Milton, Paley, and Darwin, and their respective views as to the origin of man. It is curious to reflect that all these three great men were educated at one college,—Christ's College, Cambridge.

Mr. Bryan's statement that evolution finds no support in the Bible is said to be true; but surely the survival of the fittest has never been more aptly stated than in the words

"To him that hath shall be given, and from him that hath not shall be taken away even that which he hath."

The book shows evidence of very wide knowledge, and as is natural from the pen of Professor Osborn, its treatment as regards evidence of evolution is mainly palaeontological, and embryology is not unnaturally almost ignored. After all, a man writes best on his own subject, and Professor Osborn certainly writes extremely well. He sums up the whole points in the following passages:

"Our points of agreement may be clearly set forth as follows: we both believe in the Bible and in its supreme value in moral and religious instruction; we both believe in Christianity and in the principles of conduct set forth in the Sermon on the Mount; we both believe that in the future of our country we must retain the faith of our fathers in the providence of God.

"Our points of disagreement, so far as I understand the Great Commoner, are chiefly as follows:

Bryan Believes that the Bible is the infallible source of natural as well as spiritual knowledge;

that the entire universe was suddenly created in 144 hours, according to literal interpretation of the first chapter of Genesis;

that on the sixth day man in the fullness of his powers was suddenly created, according to Genesis i, 27: So God created man in his own image, in the image of God created he him; male and female created he them.

Osborn Believes that the Bible is an infallible source of spiritual and moral knowledge;

that our entire universe and the universes beyond our own represent an incalculably long period of development to their present form;

that the life of our planet represents an incalculably long period of creative evolution which was crowned with the ascent of man; that man approaches the divine through a gradual development of his spiritual, moral, and intellectual faculties.

A. E. S.

(1) *First Course in Wireless.* By ROBERT W. HUTCHINSON. (University Tutorial Press. 3s. 6d.).

(2) *Junior Technical Electricity.* By ROBERT W. HUTCHINSON. Second edition. (University Tutorial Press. 4s. 6d.).

(1) This book is intended especially for the man who knows little or nothing about electricity and yet desires to take an intelligent interest in wireless. There are, of course, plenty of books of that kind, but this is distinguished from them by a realization that wireless is something more than an affair of soldering irons and complicated connexions. The first six chapters are devoted to simple electrical theory, and the reader, having successfully assimilated their contents, is then taken on to a review of the various transmitting and receiving apparatus. The explanations are clear and succinct, and a word may be said for the excellent diagrams. More can often be obtained from a well-arranged, simple sketch than from pages of explanation. The book will be valuable to those who not only want to use wireless, but to know something about it.

(2) "Technical Electricity," by Davidge and Hutchinson, is a book well known to most electrical students. The volume under review is an introduction to the larger work, and its utility is indicated, at least to some extent, by the fact that it has reached a second edition. The general arrangement of the subject is the same as in the larger work, but the treatment is not so wide. Electro-magnetic theory and its practical applications are first dealt with, followed by two well-written chapters on electrostatics. Current electricity follows, and some useful information is given on the subject of electrical measurements, while electro-magnetic induction and its practical applications are dealt with in a way quite adequately enough for any elementary textbook. In the final chapters generators, motors, measuring instruments, transmission, distribution, wiring, and telegraphy and telephony are dealt with.

This book, too, can be heartily recommended to the student, both professional and amateur.

F. H. M.

Popular Experiments in Dynamics. By GEORGE C. SHERRIN. (George Philip & Son. 2/-).

We are informed that demonstrations of apparatus for use with this book on popular dynamics will be given by the inventor, Mr. George C. Sherrin, at the publishers' offices, 32 Fleet Street, E.C.4, daily, from twelve o'clock, during the week commencing Monday, 13th December. Any readers who may be within suitable distance are invited to attend.

Some New Books.

(In place of our usual acknowledgment of books, we give this month a list of some new and forthcoming volumes that should interest readers. Those marked * have been received by DISCOVERY since the November issue was published.)

Science.

- **Ancient Egyptian Materials.* By A. LUCAS, F.I.C. (E. Arnold & Co. 7s. 6d.).
- **Aspects of Science.* Second series. By J. W. N. SULLIVAN. (W. Collins, Sons & Co. 12s. 6d.).
- Book of the Aeroplane.* By CAPT. J. L. PRITCHARD, F.R.A.C.S. (Longmans, Green & Co. 7s. 6d.).
- **Cargoes and Harvests.* By D. C. PEATTIE. (D. Appleton & Co. 8s. 6d.).
- Chemistry in the World's Work.* By E. HARRISON HOWE. (Chapman & Hall Ltd. 15s.).
- **Chemistry for Agricultural Students.* By R. H. ADIE, M.A., B.Sc. (University Tutorial Press Ltd. 5s. 6d.).
- Elements of Astronomy.* By E. A. FATH. (McGraw-Hill Publishing Co. 15s.).
- Elements of Mathematics for Students of Economics and Statistics.* By D. CARODOG JONES, M.A. and G. W. DANIELS, M.A., M.Com. (University Press of Liverpool, Ltd. 8s. 6d.).
- **Essays in Popular Science.* By JULIAN HUXLEY. (Chatto & Windus Ltd. 10s.).
- Forecasting Weather.* By SIR W. N. SHAW, F.R.S., Sc.D., etc. Second edition. (Constable's. 30s.).
- **Forest, Steppe, and Tundra.* By MAUD D. HAVILAND. (Cambridge University Press. 12s. 6d.).
- Frequency Curves and Correlation: An Elementary Textbook of Modern Statistical Methods.* By W. P. ELDETON. New edition. (C. & E. Layton. 8s. 6d.).
- Gum Arabic.* By H. S. BLUNT, M.A. (Oxford University Press. 10s. 6d.).
- History of Chemistry.* By ROSE STERN. (J. Dent & Sons. 2s. 6d.).
- Iron in Antiquity.* By J. N. FRIEND, D.Sc. (Charles Griffin. 10s. 6d.).
- **Manual of Plant Diseases.* By F. D. HEALD. (McGraw-Hill Publishing Co. 35s.).
- **Marvels of Modern Mechanics.* By H. T. WILKINS. (T. Fisher Unwin Ltd. 10s. 6d.).
- **Memory Factor in Biology.* By C. J. PATTEN, M.A., M.D., Sc.D. (Ballière, Tindall & Cox.).
- **Microscopic Fresh-Water Life.* By F. J. W. PLASKITT. (Chapman & Hall Ltd. 13s. 6d.).
- Naturalists' Guide to the Americas.* Edited by VICTOR E. SHELFORD. (Ballière, Tindall & Cox. 45s.).
- Natural Man: A Record from North Borneo.* By CHARLES HOSE, Sc.D. (Macmillan & Co. 30s.).
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- On the Trail of Ancient Man.* By ROY CHAPMAN ANDREWS. (G. Putnam's Sons Ltd. 25s.).
- **Pathway to Reality.* By VISCOUNT HALDANE. Cheap edition. (John Murray. 10s.).
- **Primitive Culture in Italy.* By H. J. ROSE, M.A. (Methuen & Co. Ltd. 7s. 6d.).
- **Pulse of Progress.* By E. HUNTINGTON. (Charles Scribner's Sons. 21s.).
- Romance of Comets.* By MARY PROCTOR, F.R.A.S., F.R.Met.S. (Harpers. 7s. 6d.).
- Social Life among the Insects.* By W. M. WHEELER. (Constable & Co. 16s.).
- Story of Drugs.* By H. C. FULLER. (T. Werner Lawrie Ltd. 15s.).
- Stream of Life.* By JULIAN HUXLEY. (Watts & Co. 7d.).
- Three Men Discuss Relativity.* By J. W. N. SULLIVAN. Third Impression. (W. Collins & Sons. 7s. 6d.).
- Ways of Living.* Edited by PROF. J. ARTHUR THOMSON. (Hodder & Stoughton Ltd. 7s. 6d.).

- Wireless Pictures and Television.* By T. THORNE BAKER. F.R.P.S. (Constable & Co.).
- **Wild Animals of Australasia.* By A. S. LE SOUEF, H. BURRELL, and E. TROUGHTON. (G. Harrap & Co. Ltd. 25s.).
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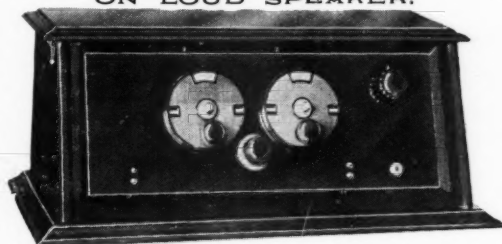
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MISCELLANEOUS ANNOUNCEMENTS.

SIR OLIVER LODGE'S reminiscences of the 1894 meeting of The British Association for the Advancement of Science were published in the special August number of *Discovery*, copies of which are still to be obtained, price 1s. 2d. each, post free. A few copies also remain of the July Empire University number, published in connexion with the Third Congress of the Universities of the Empire.

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